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CONTENTS.

EDITORIALS:
- Electric Welding 105
- Local Organizations 106
- A Record of the Art of Illumination..... 107
- Principles for Cooking-Apparatus Design..... 107

DEPARTMENTS:
- Commercial Practice 117
- Electrical Construction 120
- Dollar Wiring Kinks 126
- Pulic Service Commissions 127
- New Electrical and Mechanical Appliances..... 139
- Latest Approved Fittings 144
- Current Electrical News 145
- Record of Electrical Patents 151

LEADING ARTICLES:
- Electricity in Zinc Mining 111
- Retention of Business of Dissatisfied Customers.—By Thomas F. Kelley..... 117
- Repairing Some Hazardous Wiring—By H. G. Wilson.... 120
- The Electrical Installation in an Industrial-School Building 122
- The Morse Telegraph.—By George C. Maynard..... 129
- High-Voltage Testing Apparatus.—By F. C. Loring..... 132

BOOK REVIEW 138

MISCELLANEOUS:
- Plans for American Mining Congress and Exposition..... 108
- Long Reliability Run of An English Electric Vehicle..... 108
- Chicago Telephone Companies Seek Permission to Consolidate 108
- Thomas Ewing, Jr. 109
- The Society for Ele trical Development.....109
- National Electrical Contractors' Association..... 110
- Development Central-Station Business at Steubenville, Ohio 118
- Income From Electric Signs in New York..... 119
- New Home for Rockford Electric Company..... 119
- The Inspector and the Contractor 124
- Lighting of Motorcycle Track at Newark, N. J..... 124
- Extending the Radius of a Striking Clock..... 125
- Among the Contractors 125
- Electrical Supply Jobbers' Fall Meeting..... 127
- Technology Research Laboratory 128
- Kentucky Telegraph War Continues 128
- Lotschberg Tunnel Railway Operates 2,500-Horsepower Single-Phase Locomotives 131
- The Illumination of Factories and Workshops..... 134
- Quick Recovery from Shreveport Power Plant Fire..... 136
- Prussian Government Hydroelectric Project Approved.... 137

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ELECTRIC WELDING.

Of the modern methods which have supplanted the old process of welding by hand after heating the metal in the furnace, the only one which is purely a welding process is that known as electric-resistance welding. In this process the metal is heated by the passage of current through it, the greatest heat being developed, of course, where the resistance is highest, and this is at the point of contact of the two pieces to be welded. The heating, moreover, takes place throughout the mass of the metal, and if anything, is greater in the interior than at the surface. This results in a more thorough weld over the entire contact of the two pieces. In other methods of welding the two pieces are actually melted together. The heating is from the outside and the surface is likely to be the hottest part of the metal. The interior therefore runs a chance of not being so thoroughly welded as the surface portions.

Other methods of welding, such as the use of oxy-hydrogen, oxyacetylene and other gases in the blow pipe, have certain advantages for some forms of work; the use of thermit also is sometimes the most advantageous for very large pieces of work. The oxyacetylene blow pipe has proved most suitable for the welding of thin sheets and in a number of other special instances it has shown its adaptability. It is, however, more expensive than electric welding and is disadvantageous where the mixture of gases is not exactly in the correct proportion. Thus in handling steel an excess of oxygen may result in oxidation of the metal, and an excess of acetylene in the carbonization of the steel. Perhaps the greatest usefulness of the oxyacetylene blow pipe is in cutting metals, especially where the object is quite thick, and in this work it has a field of its own. In most cases of welding, however, one or other of the electrical methods is more advantageous.

Electrical-resistance welding, which was originated in this country by Prof. Elihu Thomson, possesses advantages for certain work over all other methods. Thus pipe joints in the shape of Y's, T's, etc., can be made shorter by this process than by any other method. It has proven very serviceable for rail joints in electric traction work, and it has a special field in the welding of small articles which can be handled in automatic machines, such as the links of chains. It is not so well suited, however, to a great variety of work, since it can best be operated by the use of machines which have been designed

for certain operations. Its greatest usefulness, therefore, is in manufacturing articles in quantity, where a definite operation has to be repeated a large number of times, and, consequently, special machines can be designed to handle the particular shape of piece which may be involved. For repair work it is not so adaptable as either the oxyacetylene torch or the electric arc welder. It can, however, be applied to nearly all metals, especially iron, steel, copper and the heavy metals, and has the advantage in addition to those above stated of a high heat efficiency. This has been known to reach 75 per cent.

The form of resistance welding known as spot welding, which consists in welding two sheets or similar pieces of metal together at particular points of the surface, has found a useful field of application, especially in replacing rivets. The strength of such joints is entirely satisfactory and the method is both more rapid and cheaper than the process of riveting. Moreover, in small ware which is afterward to be enameled it has a particular advantage, since it is not usually possible to obtain a continuous surface of enamel at the dividing line between rivet head and sheet. Spot welding is not always reliable, however, where a watertight or gastight joint is required, unless it is performed by a special type of machine, known as a seam welder.

For repair work and for certain other welding operations on large pieces the electric arc welder has a field for which it is especially adapted. This method was originated in Europe and has been used for a large number of years, although its adoption has been comparatively recent in this country. Ten years ago its application had received little notice, but it has now come to be recognized as an indispensable factor in certain forms of manufacture and especially in large classes of repair work. Even yet, however, it is not as generally known and appreciated as it should be.

As compared with resistance welding, arc welding is necessarily a surface process. It finds advantageous application in such work with sheet metal, such as the repair of boilers. The cutting of plates also can be done much more cheaply by this method than by punch press, cold saw or other similar shop tool. Its application it not confined, however, to work in sheet metal, as in repairing crankshafts and many other pieces of a bulky kind it has shown its superiority over every other method of welding. It is far preferable to riveting, and where spot welding is not suitable for replacing the rivets, arc welding will be found advantageous. The use of the electric arc necessarily entails a high temperature, and where this is only applied locally difficulties may sometimes arise from the expansion and contraction of the metal. This is easily overcome by a preliminary heating of the entire mass. From the standpoint of strength an electric weld is satisfactory for almost every purpose, the efficiency of the weld varying from 85 to 100 per cent, depending upon the characteristics of the particular metal involved.

The most satisfactory and efficient application of the arc process can be made by the use of a specially designed arc-welding machine having automatic regulation. This not only prevents the waste of energy in control resistances, but the welding machine can be designed with a drooping characteristic, which is especially suitable for the work. There are a number of arc-welding machines now on the market in this country and it is possible to apply them on both direct-current and alternating-current circuits. In the welding circuit proper the current must, of course, be direct, it being preferable for most work to make the hand electrode the negative terminal, while the object to be welded is the positive. Carbon or graphite is used for this negative electrode, except in cases where additional metal is to be deposited over the weld. In this case a metallic electrode of the same metal is used and the end of this electrode is melted off and deposited.

The disadvantage of resistance welding from the central-station standpoint is that it involves the use of large quantities of power for short intervals. It may thus prove troublesome in maintaining a constant voltage upon the circuit. A fluctuating load of this character is not always considered a valuable acquisition, but in cases where it does not form too large a fraction of the total load upon the circuit. the welding machine may be considered a welcome acquisition. In some cases it has been arranged to automatically substitute a resistance load when the welding current is cut off, but in most cases this would be a prohibitory complication. Since the ordinary welding transformer operates on single-phase, it might seriously unbalance a three-phase circuit. However, an arrangement of winding was devised by Dr. Thomson which permitted operation of a transformer with single-phase secondary from a three-phase circuit with but slight unbalancing. While an arc-welding machine will also present large and rapid fluctuations in the power demand from the circuit, it is a preferable load from the central-station standpoint, since the maximum power demand will not rise so high as for a resistance welder handling the same size of work. It is, therefore, a desirable addition to the connected load and on most circuits can be connected without seriously interfering with regulation. More general appreciation of its advantages will result in a larger extension of its application.

LOCAL ORGANIZATIONS.

Patriotism, like charity, is a thing that ought to begin at home. We have known men whose enthusiasm at the sight of the American flag and the sound of the National anthem was always liable to reach a degree nearly beyond the bounds of dignity, but who at the same time thought it smart to lie

to the tax assessor or to take mean advantage of their neighbors.

While the analogy may be a little far-fetched, the foregoing can be used to point a moral that relates to the electrical contracting business. The right sort of co-operation among contractors is largely a local kind of thing. Every contractor ought to give the National Association unstinted support, but if from his relations with that organization he does not gather an abiding inspiration to give his local competitors a square deal, he misses what seems to be the real spirit of the order. Such an inspiration, it seems to us, ought to result in the formation of local associations of contractors more frequently than it does. In every town there are problems that need short-range, intensive treatment, but which the National Association, as splendid an organization as it is, can never do better than treat in a rather general way. Hence the need of the local association.

It is encouraging to note that there seems to be a growing disposition to form these local bodies. Just the other day the Electrical Contractors' Association of the State of Illinois appointed a committee to promote their formation in the small towns of that state. This body has certainly set a commendable example.

A RECORD OF THE ART OF ILLUMINATION.

Mr. Preston S. Millar, president of the Illuminating Engineering Society, has initiated what appears to be one of the most comprehensive and determined efforts to secure definite information as to the status of electric lighting that has ever been attempted. Mr. Millar has prepared a series of 16 bulletins, each containing from one to a round dozen questions, and addressed to central stations, gas companies, municipal engineers, manufacturers of incandescent lamps, mantle gas lamps, arc lamps, acetylene supplies, oil lamps, small isolated lighting plant equipment, gasoline and acetylene lighting equipment, lighting glassware, fixture manufacturers, arc lamp-post manufacturers, ophthalmologists, school associations and commissions, railroads, street-railway companies, etc.

A review of the attempted scope of the inquiry thus promulgated indicates that a great deal of enterprise, ingenuity and physical labor have already been involved. If those to whom the survey goes participate to a very small degree in answering the questions with which they are familiar, the aggregate information will afford some very valuable data. Mr. Millar has prepared for himself what appears to be a monumental task, and it is to be hoped that his willingness to undertake this compilation will be recognized and appreciated, and that there will be forthcoming in short order enough replies to his inquiries to enable him to make an adequate presentation of the subject at the next meeting of the Illuminating Engineering Society.

PRINCIPLES FOR COOKING-APPARATUS DESIGN.

There is no occasion today to descant upon the benefits accruing from standardization. They have made themselves obvious in many fully established departments of electrical manufacture, while in other directions the failure to secure the advantages but emphasizes the lesson of what might have been. Part of the movement in some countries has been to avail of standardization to bring order out of chaos, to increase efficiency, and to cheapen cost. The experience of the past in these respects may be responsible for the desire to prevent the chaos by standardizing early, and to manufacture cheaply almost from the beginning.

The desire to secure an immediate and sweeping success with electric cooking business is a matter for congratulation because it indicates the possession of a faith and spirit which should help to win; but when, with excessive zeal, standardization of still developing apparatus is advocated as a means of arriving at that speedy successful issue, it is conceivable that short-sighted policies may follow, preventing ultimate success. The proposals for standardization of cooking stoves, which eminated from the brain of some municipal electrical engineers in England who want to boost that section of supply with strength and vigor, have therefore called forth a statement of policy in this connection from the enterprising "Point Fives Club." The matter was recently debated with the result that agreement was arrived at on five points relating to cooker design; these we record here. The "Point Fives" or the "Cent-per-Unit," as we may term them, deny any wish to hamper cooking-apparatus development by standardizing details at this early stage but they set forth a number of general preliminary principles which practical cooking experience has proved to be of importance. Domestic and other cooking ranges, consisting of oven, grill and hot plates, they say, should have each sub-circuit separately fused and protected by a switch; the oven should have two or more circuits. Switches and fuses it is suggested should be placed in such a position that they cannot become unduly heated, cannot be damaged by liquids being spilt over them, and they should be easily accessible. Provision should be made for efficiently and thoroughly grounding all apparatus. Further, cooking ranges should be fitted with at least one indicating device (separately fused), which will show clearly whether any circuit is turned on. Finally manufacturers and designers are urged to endeavor to develop a hot plate which will work satisfactorily at a red heat.

This series of principles laid down by a body of electrical supply men who are in close touch with the individual consumer, will be of use as a basis for further discussion and also for the guidance of designers, but it is not inconceivable that present-day manufacturers would have comments to offer.

Plans for American Mining Congress and Exposition.

Manufacturers of mining machinery, rescue and first-aid apparatus and safety appliances are to be given an opportunity to display their wares before the mining men of the country at a great industrial exposition to be held under the auspices of the American Mining Congress, in Philadelphia, Pa., the week of October 20.

This exposition, the first of its kind in this country, will be held in conjunction with the annual convention of the American Mining Congress and the double attraction is expected to attract thousands of interested men. It will be entirely national in scope, the metal-mining interests of the West to be as fully represented as the coal mining interests of the East. In fact, there is a tentative plan to have a gold mining camp in full operation with a mill crushing the ore. Horticultural Hall, the biggest place of its kind in Philadelphia and situated in the heart of the city, has been engaged for the occasion.

While the plans are still in embryo, a number of the leading manufacturers have already been approached and have shown sufficient enthusiasm to lead to the belief that all of the space will be taken in a short time and that there may not be enough to take care of all who apply.

A number of the big coal companies that have developed the "Safety First" movement at their mines are now negotiating for large amounts of space to show the mining men and the public what they are doing in behalf of their men. These companies will send rescue and first-aid crews and it is proposed to have exhibition drills, and contests between the various crews. The United States Bureau of Mines will be represented by one of its safety cars and a picked crew of helmet men. The State of Illinois and a number of the big anthracite companies may send rescue cars for exhibition purposes.

"This exposition will not only be of untold value to the mining men of the country," said James F. Callbreath, secretary of the Congress, "but it will also show the magnitude of the industry to the entire country. We know that it is a gigantic industry, second only to agriculture, employing directly more than a million and a half men, and with a yearly output of two billion dollars, but the public has never given it the recognition it deserves. The convention which will be held at the same time as the exposition, will be the most important body of mining men ever gathered together. The industry has been making great strides in the last few years and a number of problems have arisen that are to be fully discussed straight from the shoulder."

Although the convention is to be held in the East, it will not be an eastern affair, for the most troublesome topics are coming from the West and western men are coming, many of them in special trains, to discuss these questions as affecting the entire industry. The convention is to be the first get-together affair of all the mining interests of the country and an attempt is to be made to show the need of a stronger national organization that will represent all phases of the industry and lead to the placing of the industry in the important place it belongs.

Perhaps the leading topic of the convention will be the new system of mine taxation recently put in operation in some states and being discussed in others at the present time. It is expected that the West will be insistent upon a definite policy toward Alaska from Congress and there will be a demand for quick action. The smelter-fume problem, which also belongs to the West, will be discussed dispassionately with the hope that an amicable adjustment may be reached soon. The disposal of debris from placer mining is another question that will be brought up.

The coal men of the East will be mostly interested in two problems, the "Safety First" movement and the conservation of the coal lands adjacent to the great eastern industrial centers. This latter, it is said, has become a question of most serious moment. It is fully realized by the eastern men that their coal fields are being used up at a tremendous rate. The proposed system of leasing mineral lands will also come up for extended discussion. The fact that the Federal Government some time ago leased coal lands in Wyoming to a coal company, thus making the entering wedge in this system of disposing of the Government's mineral lands, will undoubtedly call for considerable comment. There is also the proposal for the revision of all the mining laws of the country. A great many mining men are of the opinion that the laws are antiquated and cumbersome, imposing hardship upon everyone who has to deal with them.

Albion Power Plant Destroyed by Fire.

The power station of the Commonwealth Power Company, at Albion, Mich., was destroyed by fire on June 30. During a severe storm a lightning stroke was conveyed into the building from the high-tension lines and fire was started at the switches. The machinery was damaged beyond repair and will have to be replaced.

Long Reliability of an English Electric Vehicle.

Considerable interest is being manifested throughout Great Britain at the present time in the exploitation of the electric vehicle. Although the conditions there are peculiarly favorable to the use of this type of car, both on account of the excellent road conditions and the close proximity of towns with electric supply stations, but little development of the use of electric vehicles has as yet taken place. In order to stimulate interest in this branch of the industry a reliability run was undertaken at the suggestion of the Edison Storage Battery Company. Arrangements were quickly made for the run, which took place from Dumfries, Scotland, to London, England, a total distance of 362 miles. The run was begun at 3 a. m. on June 9 and concluded at 1 p. m. on June 11, the total elapsed time being 58 hours. The car was equipped with Edison batteries and was operated and driven throughout the journey by M. E. Fox, of the Edison Storage Battery Company. The total running time was 29 hours and 50 minutes. The average speed was 12.3 miles per hour. Most of the balance of the time between that actually spent in running and the total elapsed time of 58 hours was spent in charging the batteries, which was done at a very high rate. The average cost for energy per mile run was 1.34 cents. The average watt-hours output per ton-mile was 170. The run was completely successful in every respect and strikingly demonstrated to the people in the many cities through which the car passed the practicability of operating electric vehicles in any part of the country.

Chicago Telephone Companies Seek Permission to Consolidate

The Illinois Tunnel Company, of Chicago, Ill., appealed on July 14 to the City Council, Committee on Gas, Oil and Electric Light, for permission to sell its automatic system to the Chicago Telephone Company. The Illinois Tunnel Company was represented by its attorney, Daniel J. Schuyler. No figure was submitted representing the assumed purchase price of the Tunnel Company's system. The Automatic Company is said to have in the neighborhood of 30,000 subscribers. The Tunnel Company's maximum rate is $85, while the Telephone Company's maximum rate is $125. The proposition was postponed without date.

In Italy there is only one company manufacturing electric automobiles. It is located at Milan.

Thomas Ewing, Jr.

The appointment of Thomas Ewing, Jr., to be Commissioner of Patents, was confirmed by the United States Senate on July 10. Mr. Ewing is a lawyer of great prominence, and the administration has been fortunate indeed to secure the services of so able and conspicuous an attorney and gentleman to carry on the great work of the United States Patent Office.

Thomas Ewing, Jr., was born at Leavenworth, Kans., May 21, 1862. He is the son of General Thomas and Ellen Ewing (Cox) Ewing. He was a student at the University of Wooster, Ohio, from 1879 to 1881. He received the degree of Bachelor of Arts from Columbia University of New York in 1885, and the degree of Master of Arts in 1886. He attended the law school of Columbia from 1887 to 1888, and was a tutor in the School of Mines, Columbia University, from 1885 to 1888. He received the degree of Bachelor of Laws from Georgetown University in 1890.

Mr. Ewing was assistant examiner in the United States Patent Office from 1888 to 1890, and since 1891 practiced in New York, making a specialty of patent law with the firm of Ewing & Ewing. He has solicited some of the most conspicuous patents in the industrial world, including the fundamental patent of Frank J. Sprague on the multiple-unit control of electric train operation, and Prof. M. I. Pupin's patents on long-distance telephony. He is president of the Current Literature Publishing Company, and was associated as a director with the Crocker-Wheeler Company, of Ampere, N. J.

Mr. Ewing was Democratic candidate for mayor for Yonkers, N. Y., in 1897 and 1899. He was a member of the Yonkers School Board from 1897 to 1903, and the Yonkers Police Board from 1905 to 1907. Since 1910 he has been president of the Yonkers Tuberculosis Hospital Commission.

He is a member of the Sigma Chi and Phi Beta Kappa fraternities. His clubs are the University, New York and Columbia University. He is the author of "Jonathan," a tragedy, 1902, and of some metrical translations of Horace which have appeared in "Poet Lore."

New England Section Program.

The program for the fifth annual convention of the New England Section, National Electric Light Association, to be held September 17, 18 and 19, at Hotel Vermont, Burlington, Vt., has been announced, as follows:

"Co-operation of Allied Electrical Industries."

"Problems of Central-Station Managers in Cities of Less Than Five Thousand Inhabitants."

"Some Phases of the Merchandising of Electric Appliances."

"Principles Governing Central Stations in Line Extensions, and various Rulings of Commissions Thereon."

Thomas Ewing, Jr.,
United States Commissioner of Patents.

"The Central Station's Attitude Toward Its Customers."

"Recent Development of Incandescent Lamps."

"The Electric Vehicle."

Free Tungsten Renewals in New York.

The New York Edison Company, the United Electric Light & Power Company, and the Edison Electric Illuminating Company of Brooklyn have decided to make free renewals of tungsten lamps in sizes of 100 watts or larger. This arrangement will go into effect on August 1, the schedule having been already filed with the Public Service Commission.

The Society for Electrical Development.

At a full meeting of the Board of Directors of the Society for Electrical Development, Incorporated, held at the headquarters in the Engineering Societies Building, New York, on July 9, as was announced in last week's issue, arrangements were made for carrying forward actively the plans of the society, so that the work in aid of the electrical industry may be well under way by the beginning of the Fall lighting season. The organization committee advanced additional funds for this purpose, and the membership campaign will be pushed with vigor so that pledges totaling $200,000, the minimum required, may be obtained at the earliest possible moment. All persons who are interested in the aims of the Society are urged to become members at once, in order that their pledges may aid in bringing the total without delay to the necessary minimum. Only a small part of the amount pledged will be needed for the beginning of the active work, but it has been agreed that the subscriptions must reach $200,000 before any of it can be used.

Much information concerning the aims of the society is given in the prospectus now being distributed to all persons interested. The by-laws of the society are so drawn as to give equal representation to all branches of the electrical industry. A general invitation is extended to all individuals, partnerships, and companies composing the electrical industry to become members. Although the dues are based on the gross amount of sales made annually by the members, yet it is unnecessary for a member to make public the information concerning the exact amount of his sales. A member may subscribe in accordance with a classification in groups, of which there are seventeen, each group representing sales, from one and a quarter to two and a half times the amount of the next lower group.

The quantity of coal used for coke making in the United States in 1912 was 65,485,801 short tons, according to the United States Geological Survey. The coke produced from this coal amounted to 43,916,834 short tons, valued at $111,523,336.

National Electrical Contractors' Association.

The annual convention of the National Electrical Contractors' Association was hed at the Hotel Patten, Chattanooga, Tenn., practically all of the past week. Following the executive committee meeting on Tuesday morning the balance of the day was given over to the registration of delegates and guests, and the convention opened with a formal session on Wednesday morning. Other sessions were held on Wednesday afternoon and on Thursday and Friday, the entire day on Saturday being given up to a visit to the battle fields and the Tennessee lock and dam.

Enroute to the convention a large delegation of contractors were entertained at Cincinnati at the Sinton Hotel by the Cincinnati contractors. This included an automobile tour of the city, a visit to the zoological gardens, dinner at the club house, a cabaret show and a demonstration at the station speeding the parting guests. L. T. Milnor acted as toastmaster and the address of welcome was delivered by the Hon. Henry T. Hunt, mayor.

The visiting contractors reached Chattanooga on a special train Wednesday morning. At the opening session Joseph A. Fowler welcomed the delegates and guests, the response being made by Ernest Freeman, president of the National Electrical Contractors' Association. Other addresses were made by H. Clay Evans and T. C. Betterton, of Chattanooga, and A. N. Shoen, of Atlanta, Ga. At the executive committee meeting on Tuesday a committee was appointed to investigate the practicability of the National Association guaranteeing the work of its members. There were over 200 members and guests registered.

German Electric Railway Statistics.

The official statistics relating to German electric railways for the year ended March 31, 1912, show a total of 283 undertakings, an increase of 15 as compared with the preceding year. More than 25 per cent of the lines carry freight. The length of single track is 2,983 miles, an increase of 174 miles. The average seating capacity of the cars is about 35. Of the entire number 132 undertakings are owned by municipalities and 136 by private companies. There are several traction syndicates, one of which operates seven street railways with a total of 87 miles. The railways carried 2,567,155,295 passengers for 428,000,100 train miles, which included approximately 313,100,000 motor-car miles. The increase in car miles as compared with the preceding year was about 38,000,000 car miles, and the increase in passenger travel about 251,000,000. The freight traffic also increased from 1,460,664 metric tons to 1,794,585 metric tons. The greatest density of traffic was shown by the Berlin subway-elevated system, with 1,122,485 passengers per mile, while the density of traffic on the surface system in Berlin was 645,669 per mile. The subway-elevated company also carried 7.2 passengers per car mile as compared with 6.9 passengers per car mile on the surface system. The total gross earnings, exclusive of non-reporting companies which operated a total of 120 miles of track, were $65,180,626, compared with $59,763,595 in 1910. The highest earnings per mile of track were achieved by the Berlin subway-elevated system, with $161,404, comparing with $67,856 by the Berlin surface system. The operating expenses, including employees' welfare, taxes and franchise payments, amounted to 86.4 per cent of the gross earnings. Tax and franchise payments constituted 7.4 per cent of the gross earnings. Of 170 Prussian railways 16 paid no dividend, three had a dividend up to one per cent, 13 up to two per cent, 17 up to three per cent, 26 up to four per cent, 19 up to five per cent and 68 of five per cent to 10 per cent and more than 10 per cent. Five of the non-dividend lines were newly constructed.

Electric Lights in Westminster Abbey.

The monastic gloom which has pervaded the Abbey of Westminster for so many years has now been dissipated by the installation of a new lighting scheme which makes it the best illuminated of our abbeys and cathedrals, electric lamps having been installed in every nook and corner.

The new scheme of illumination has taken three years to perfect, and the abbey has now 250 electric lamps, hanging in groups of four and six from the distant roof. The electric current is supplied from an underground cable.

The electric lamps are so arranged that the minute print of the average prayer book can be read during evening services in the most remote retreats of the building.

Power House at Speigner, Ala., Formally Opened.

In the presence of a large number of state officials and prominent visitors from Montgomery and Elmore Counties, Governor O'Neal of Alabama, on July 5 pressed the button that started the new $100,000 hydroelectric power plant at Speigner and set the machinery of the cotton mill in motion.

Prior to this ceremony Governor O'Neal said in a few remarks that the dreams of the engineer in charge of the vast work had become a reality, and that the State would henceforth reap the benefit of one of the most important pieces of work ever accomplished in Alabama.

Norwegian Railway Electrification.

Work is well in hand on the conversion of the railway between Christiania and Drammen, Norway, a distance of about 33 miles, from three feet 6 inches to standard gauge, electric traction. A double track will be laid as far as Sandviken, 8.25 miles, but whether energy shall be taken from private companies or whether the government will establish its own power station has not yet been decided. As to rolling stock, seventeen electric locomotives of from 320 horsepower to 800 horsepower and eleven combined locomotives and carriages of 300 horsepower have been ordered. The latter are intended for use with a trailer on the Christiania-Asker section of the line, which is 14 miles long.

Hartford City (Ind.) Use Electric Pumps.

Electric pumps are to be installed in the city's municipal water plant by the American Gas & Electric Company in a trial to prove that water can be pumped cheaper with electricity than steam. If the test proves the claims of the light company it is probable the council will purchase the pumps, maintaining the present new battery of boilers as an emergency plant. During the trial water will be pumped direct into the mains to enable the city to empty the big reservoir so that workmen may enter it, clean out the sediment and make needed repairs. If electric pumps prove practical the city will not have to construct a new cistern.

Joint Picnic of the Vehicle Men and Garage Owners.

The first annual picnic and field day of the Chicago Garage Owners' Association, and the Chicago Section, Electric Vehicle Association of America, will be held at Cedar Lake, Ind., on July 25. A special train has been chartered for the occasion, which leaves the Polk Street depot at 10:30 a. m.

Athletic contests for ladies and gentlemen and a baseball game between two teams representing the two associations have been arranged for. Prizes amounting to several hundred dollars have been donated for the victors in the various contests.

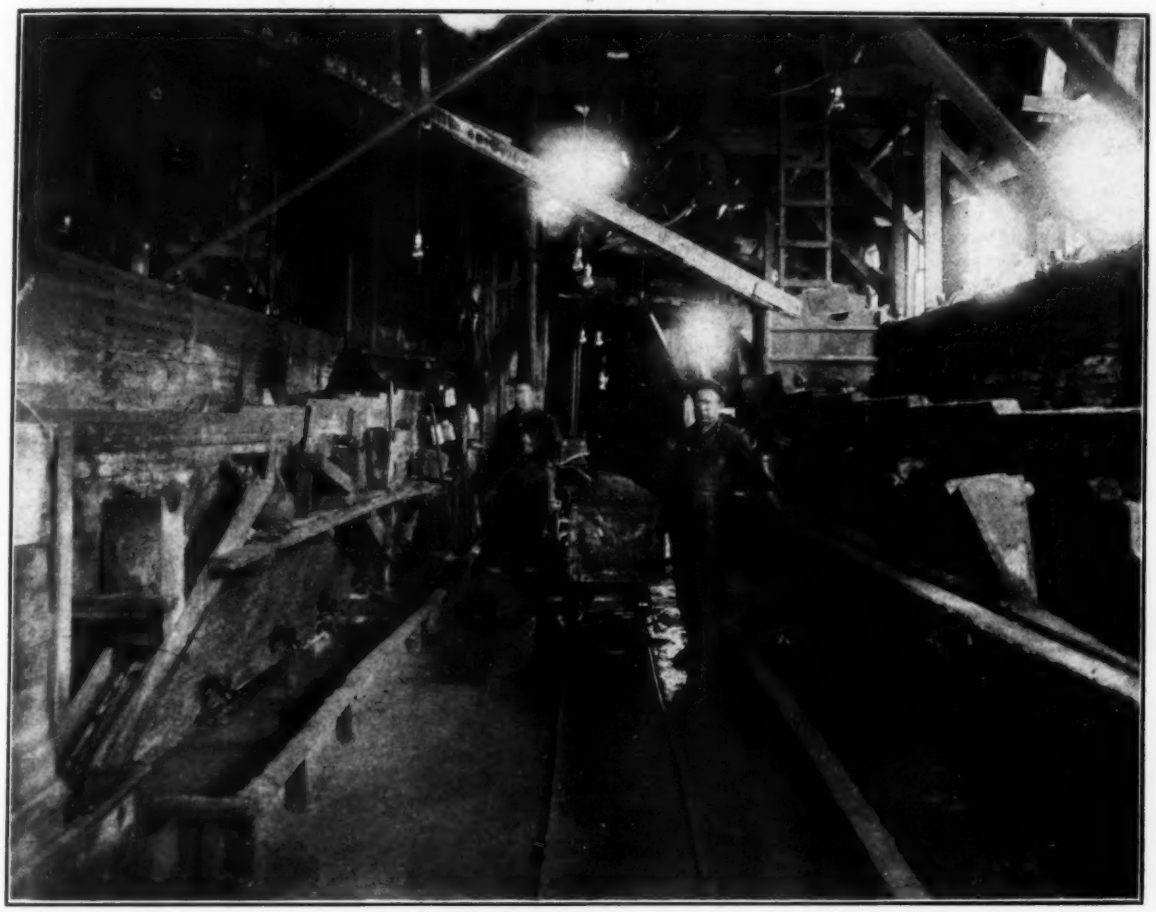
New Officers of Illuminating Engineering Society.

At the recent election of the Illuminating Engineering Society the following officers were elected for various terms beginning October 1, 1913: President, Charles O. Bond; vice-presidents, George H. Stickney and Ward Harrison; general secretary, Joseph D. Israel; treasurer, L. B. Marks; directors, F. J. Rutledge, C. A. Littlefield and F. A. Vaughn. Messrs. Israel and Marks were re-elected to their respective offices.

Electricity in Zinc Mining.

The extension of transmission lines to the zinc mines of the Illinois and Missouri fields has resulted in the general adoption of electric drive by mines in these territories, resulting in considerable savings. Motor applications and power requirements of zinc-mining machinery are discussed in this article.

There are two prominent zinc districts, supplying practically 80 per cent of the spelter zinc used in the United States, in which electric power is being widely used for all mine operations, namely, the Southwest Missouri district, supplying 65 per cent of the spelter, and the Illinois-Wisconsin district supplying 15 per cent. In the latter district a saving of many thousands of dollars is being effected and the development of the properties greatly accelerated by the use of electric power. The percentage of saving has, in fact, been larger than would ordinarily have resulted elsewhere under like circumstances, owing to the local conditions governing the industry. In the first place the cost of fuel is high and in the majority of cases would have to be hauled over bad roads several miles from the nearest railroad point. Also a majority of the mines are small and could not secure sufficient capital to erect an efficient steam-generating station.



Mill Room of Vinegar Hill Mine.

The development of the mining industry in this district has, therefore, been co-incident with the extension of the transmission lines of the Interstate Light & Power Company, of Galena, Ill., to the mining districts and the managers of the various mines have been prompt to realize the advantages of the new system. The lines of this company now serve about 30 mines, representing a total connected load of 5,000 horsepower, and situated in an area of about 280 square miles.

The rates for energy comprise a charge of $1.00 per horsepower connected and a kilowatt-hour charge ranging from two to eight cents, depending on the consumption per month.

Energy for use in the mining districts is transmitted to five principal centers of distribution, where substations of the following capacities have been erected: Hazel Green, 1,500 kilowatts; Platteville, 750 kilowatts; Cuba City, 450 kilowatts; Shullsburg, 300 kilowatts, and Darlington, 300 kilowatts.

In the Missouri districts the Empire District Electric Company, of Joplin, has made remarkable strides in supply power to zinc mines, a majority of the mines in this territory being electrified.

Briefly, the operations involved in lead and zinc mining are as follows:

Rock from the mine pit is hoisted in skips or buckets containing 800 to 1,500 pounds of rock, from depths ranging down to 250 feet or more, at speeds of from 600 to 1,200 feet per minute. Motors for driving hoists are usually geared to the hoisting mechanism and range in size from 37 horsepower to 52 horsepower.

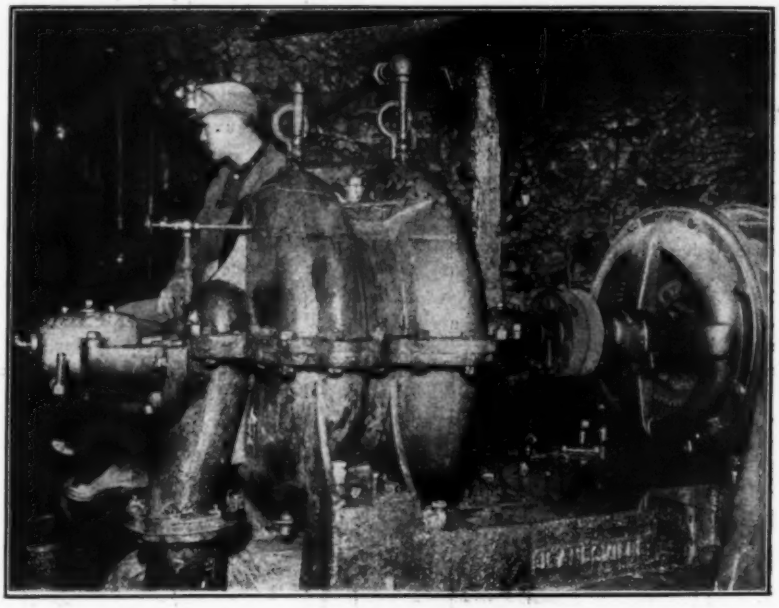
For this service the wound-rotor type of induction motor, in which variation of speed can be secured by insertion of resistance, is usually specified, although the squirrel-cage motor is used in many instances.

For the first reduction of the mine product, jaw crushers of the Blake or Dodge type are ordinarily used, the bucket hoists discharging directly into these. In the average mines crushers of standard size—7 by 14 inches—are used. Crushing rolls ranging in size from 24 to 36 inches diameter further crush the rock.

The jigs for both roughing and finishing, are usually of the Harz type and with the crushers, and bucket elevators are driven by one mill motor. This method of drive is commonly used because of the fact that the process of reduction and concentration is a continuous one and there is ordinarily no economy in individual drive.

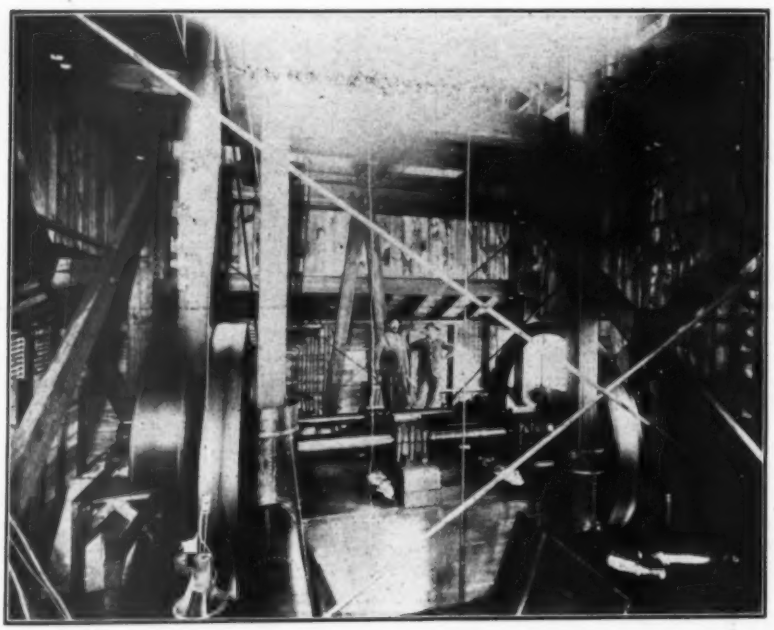
Air for the pneumatic drills is furnished by compressors capable of supplying, say, 4 to 6 outfits, driven by motors of 50 to 75 horsepower, with many equipments of smaller capacities in service. The use of synchronous motors and their characteristic of building up or equalizing the power-factors of electric systems will eventually be made an important element of operating economy. A number of such installations are now under consideration.

The most important feature in zinc mining, from the power standpoint, is pumping. In the Missouri district the mines are worked at present at an average depth of 200 feet. Into practically every mine flows a fairly large amount of water. This water must be pumped out before the mine can be worked, a fact which gives a vague idea of the importance to the mine operator of keeping his mine dry.



Motor-Driven Centrifugal Mine Pump.

Water in a mine is a great deal like snow on a railroad track. The income ceases and the expense increases. As an illustration take a mine worked at the 200-foot level. This mine supplies dirt to a 200-ton concentrating mill and has been worked for five years. In other words 500 1,000-pound cans have been hoisted 26 days a month for 60 months. This gives a total of 780,000 cans and as each can holds enough dirt to displace 70 gallons of water it will require 54,600,000 gallons to fill the space left. The regular flow of water we will assume to be 400 gallons per minute or 17,280,000 gallons per month. If, then, the mine is full of water and it is dry in a month it will be necessary to pump the 17,280,000 gallons of regular flow over and above the 54,600,000 gallons standing in the mine. The average cost of electric pumping under these conditions is 1.5 cents per 1,000 gallons. It, therefore, will cost $259 to pump the 17,280,000 gallons and $819 to pump the 54,600,000 gallons. This gives a total of $1,078 and makes no allowance for water held in pores of the rock, in natural caves and in adjoining mines which will flow in and materially increase the cost.



Two Cross-Head Lift Pumps Driven by 75-Horsepower Motor.

In the early days of mining in the southwest Missouri district the mines were shallow and most anything answered fairly well for a pump. Most of the pumps then used were modifications of the bucket elevators now used in the mills. Since those days the crudest pumps have been discarded and the cruder ones are gradually following in their wake. The pumps now in common use are lift and walking-beam pumps, steam pumps and centrifugal pumps.

Lift and walking-beam pumps show a high efficiency and when driven by gas engines the fuel cost is very low. Nevertheless, the shut-downs for repairs to either the engine or the pump make this method very expensive. The pump and the engine cannot be relied upon for continuous operation but water is constantly flowing into the mine and unless a steam pump is kept in readiness to start immediately, whenever the other pump goes down the money spent for pumping will never yield results. A lift pump driven by an electric motor or a steam engine

75-Horsepower Motor Driving Air Compressor.

is much more reliable but is not practical for pumping. The lift pump does not give the same satisfaction for mine pumping it does for pumping from deep wells. This is true for two good reasons: First, mining the ore causes the earth above to settle and sometimes to cave in with the result that the drill hole containing the pump tubing cannot long be kept straight; secondly, the dirty water, the blasting and the rough usage the miners are likely to give it are bound to cause the pump to give trouble.

Pumping with steam pumps is the most inefficient method used. The steam pump itself is very inefficient and the long line of steam pipe leading to it allows a great deal of condensation. The average pipe line is about 300 feet long and poorly insulated if insulated at all. It is, therefore, safe to add to the horsepower of the pump four horsepower per hour for condensation in the steam line. This makes the cost of pumping with steam run from two cents per 1,000 gallons for the most economical installations having short well insulated lines up to 5 cents or more for the less economical ones having long steam lines. Aside from the cost of pumping, the steam pump has some advantages. It is not materially injured by remaining for some time under water. If the pump is below the surface of the water it can be operated with compressed air till it is uncovered and it will not be necessary to install another pump. The increased cost of pumping, however, more than offsets all the advantages the steam pump has over other forms of pumping.

Both the vertical and the horizontal centrifugal pump are now coming into general use. In the older installations of centrifugal pumps the horizontal pump was used exclusively. It was belt-driven and inefficient. Tests made at two mines show the following results: One pump was running on a by-pass and showed a combined efficiency of 15 per cent. When the by-pass was closed the combined efficiency rose to 58 per cent. At the other mine the efficiency was 45 per cent, and it is safe to state that none of the old installations will show a combined efficiency of more than 45 per cent.

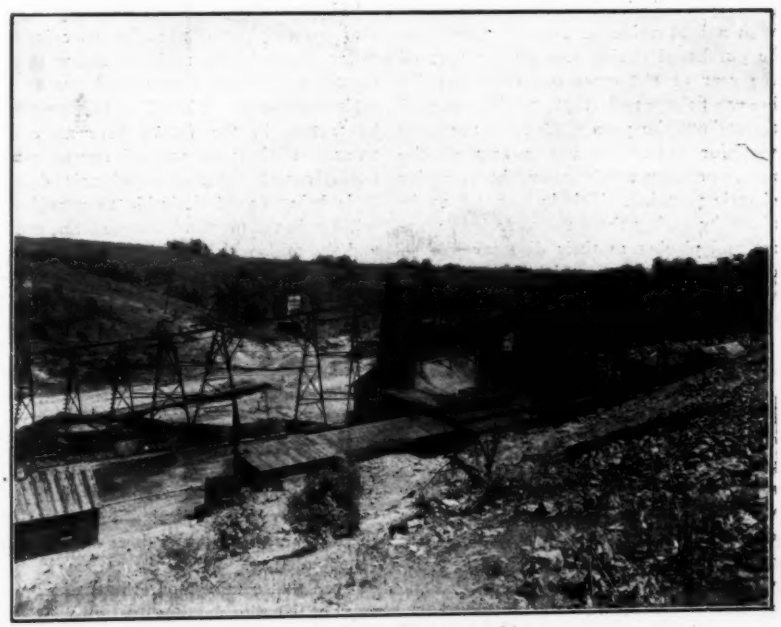
The new pumping installations in old mines are practically all direct-connected motor-driven horizontal pumps. A great deal more care is taken with these and their efficiency will run from 50 per cent up. In figuring on these new installations central stations use the formula

$$H.\ P. = G.\ P.\ M. \times H/2{,}000$$

H. P. is the power required to be put into the motor to do the work; G. P. M. is the gallons per minute and H. is the total head. This allows about 50 per cent for the combined efficiency and places the current consumption as high or higher as it proves to be after the installation is running.

The centrifugal pump is the ideal mine pump. It can be direct-connected to a motor, thus doing away with all belts and leaky steam lines. It takes up little room, requires little attention and is very nearly fool-proof. The power used varies with the quantity of water pumped rather than with the head against which it is pumped. This means that if the discharge pipe is completely closed the power consumption will decrease and there will be no danger of burning out the motor. Again, the power consumption is not dangerously increased if the discharge pipe is broken close to the pump case.

The rate of flow from a centrifugal pump may be regulated in two ways. Vary the speed or throttle the discharge. The most satisfactory results are obtained by running the pump at its greatest efficiency and shutting down after the water is pumped out, but where there is not sufficient space in the mine to store water and the total flow of water must be pumped out as fast as it runs in, the most satisfactory way is to regulate the pump by throttling the discharge. This is true in spite of the fact that varying the speed may at some points actually raise the ef-



General View of Zinc Mine. Electric Substation in Rear.

ficiency of the pump and that throttling always lowers the efficiency. In a mine it is advisable to have everything as simple and rugged as possible and for that reason the motor with a squirrel-cage winding has more advantages than the gain in efficiency which might be obtained by installing the best variable-speed motor. If due care is taken in selecting a pump the quantities of water necessary to pump can be handled without too great a sacrifice in efficiency. The efficiency of a pump when working on a throttled discharge may be found by the following formula:

$$Et = En \times Hu/Ht$$

Et is the efficiency obtained from the pump when throttled. En is the highest efficiency the pump will give when delivering the required amount of water at the given speed. Hu is the actual head utilized and Ht is the head at which the pump would deliver the water or the head which is caused by throttling. As an example take a ten-inch single stage pump running at 1,125 revolutions per minute. This pump shows an efficiency of 65 per cent when delivering 800 gallons per minute against a head of 113 feet. If the discharge is throttled so that this pump delivers this quantity of water against a head of 100 feet our formula gives an efficiency of 57.7 per cent.

At this pump efficiency, if we have a direct-connected motor of 90 per cent efficiency, we get a combined efficiency of over 50 per cent. With a little study of the characteristic curves of the different size pumps and a knowledge of the amounts of water to be pumped, together with the variation in quantity, it is possible to so arange the pumping installation that the combined efficiency is always above 50 per cent even when the pump is throttled.

In spite of the fact that natural gas with a heat value of 1,000 B. T. U. can be purchased during the greater part of the year at 12.5 cents per 1,000 feet for boiler firing and that it is supplied throughout the year at 25 cents per 1,000 feet for gas-engine use, nearly all the mine operators are becoming boosters for electric pumping. This has been brought about by giving them the very best service and placing at their disposal free of charge all the engineering advice necessary to decide on the best and most economical installation.

Regarding pumping in the Illinois-Wisconsin mines the *Mining and Engineering World*, in a recent issue, says:

"A considerable amount of water is required for sluicing ore through the grizzles, for the jigs and other mill equipment, and the general practice is to utilize what comes from the mine. Where this does not suffice for putting through only once, a pond reservoir is provided, to which it flows for settling and re-use. The quantity of water needed for the reduction of the ore compares with the latter in bulk as about 10 to 1. In keeping the mines clear of water, piston or plunger pumps, largely of the old Cornish type, have heretofore been principally used; and, where these were changed to electric drive, they took motors of 35 to 75 horsepower as a rule. The increasing application of electric power is, however, bringing about the installation of centrifugal pumps, which can be direct coupled on the same shafts with the motors, thus making compact and relatively inexpensive units, which can be put in almost any position, will operate at low cost for maintenance and repairs and require a veritable minimum of attendance. Sizes of motors range from 15 to 75 horsepower.

"The reliability of electric drive with units of this type is shown by the experience of the Cleveland Mining Company, with a two-stage centrifugal pump of 1,200-gallons per minute capacity installed near the bottom of the hoisting shaft of the Cleveland mine. This is driven at 900 revolutions per minute by a 75-horsepower motor, which has frequently operated in water up to its bearings, and been started under these conditions. It is related that at one time the set was submerged in water 6 feet deep for a period of 14 hours. After the water had been removed by a Cornish pump, so that the motor could be started, it was run for only 10 minutes in order to dry out the motor coils, after which the suction of the centrifugal pump was opened and full load safely imposed upon the unit. This set has been in operation for about two years, and conditions almost as unfavorable have been of not infrequent occurrence during that time; notwithstanding which the efficiency of both pump and motor has remained unimpaired.

"Single-stage, centrifugal pumps are also coming into use for circulating water through the mill, as above mentioned, and simple rotary sand pumps to replace elevators in handling tailings may be factors in the future here as elsewhere. Both types are, of course, particularly well adapted to electric drive. It is being found desirable to provide a settling basin or pond between the mine and the mill, which will also serve as the reservoir already referred to, for the reason that water freed from sediment increases the efficiency of the milling process. Otherwise, lime and other substances carried in suspension form a thin film or coating on the concentrates and retard the milling of the ore in its final stages."

The accompanying data sheets give detailed information relative to the electrical equipment of six typical mines, three in the Missouri district and three in the Wisconsin district. From these data it can be seen that a mine, operating 24 hours a day and handling about 250 tons of rock, equivalent to 30 tons of concentrates, is equipped with a 100-horsepower mill motor driving jigs, crushers, and elevators; a 37-horsepower motor on the hoist; a 75-horsepower motor on the air compressor; 75-horsepower on the mill pump, and 10-horsepower driving fans.

Quoting further from the *Mining World*, "The average mill equipped with, say, a jaw crusher, 2 or 3 crushing rolls, 4 or 5 elevators, 2 trommel screens, 4 to 6 jigs, and other auxiliary apparatus, including pumping machinery, can all be operated from a 'bull' motor of not exceeding 100 horsepower. Such a mill has capacity for treating 100 to 125 tons of rock in an 8 or 10-hour shift; and the isolated power plant required for operating it formerly ranged in size from 200 to 250 horsepower. As the work is now performed, where electric power has been made available, by motors having single or combined ratings, normally of less than half that capacity (although capable of heavy temporary overloads), many managers have not hesitated to discard the power plants heretofore used, even in cases where they had only been in operation for a short period. Some mines recently opened, however, have been enabled to secure electric service from the start, thereby effecting a very appreciable saving in the original investment cost."

A noteworthy feature of the situation above cited is the fact that in Wisconsin-Illinois zinc mills the consumption of current, while increasing with the tonnage put through, is relatively decreased by speeding up the process of reduction. In other words, as an authority on this field puts it, if 150 tons are crowded through a mill in 8 hours, the consumption of current per ton will be less than if 125 tons are handled in 10 hours. This can be easily understood when the unavoidable friction of shafting and counter-shafting, slippage of belts, etc., are taken into account; and reduction of such losses by crowding the equipment has proven in actual practice to be more economical than avoiding them by installing separate motors for each machine or group of machines.

The pumping and jigging power requirements, separately considered, are practically proportional to the time, rather than the tonnage. Figures taken from a mill having a 7 by 14-inch jaw crusher, 36-inch rolls, trommel, two elevators, two sets of jigs and a centrifugal pump, showed a consumption of 940 kilowatt-hours for 237 hours actual running time in a month. This is equivalent to a consumption, for the 3,900 tons handled, of a trifle less than 2.5 kilowatt-hours per ton. The net kilowatt-hour use of current per hour of mill run was 39.8 kilowatts, or 53 horsepower. Thus it will be seen that nearly double the load really carried could have been imposed upon the 75-horsepower induction motor with which the mill was equipped.

Zinc Mining Data—Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Zinc mine, located near Galena, Ill., having an average output of 25 tons of mineral per day. There are 60 men employed working in three shifts of 8 hours.

Total connected horsepower, 346. Total number of motors installed, 9. Average kilowatt-hours per month, 66,318.

Kilowatt-hour consumption for 12 months: January, 69,410; February, 67,880; March, 68,290; April, 62,810; May, 58,960; June, 67,400; July, 66,480; August, 69,510; September, 64,450; October, 66,380; November, 67,060; December, 67,200. Load-factor, 35 per cent.

The approximate energy consumption per ton of rock mined is 10.2 kilowatt-hours.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts. Motors are of the squirrel-cage induction type.

No.	Horse-power.	Speed R. P. M.	Application.
1	100	720	Belted to line shafting driving one 7-cell roughing jig; one 7-cell sander jig; one 7-cell cleaner; one 4-cell lead jig; one 15-inch jaw crusher; three 14-inch roll crushers; four bucket elevators; and one 750-gallon American Well Works centrifugal pump.
1	50	900	Belted direct to one Cornish cross-head lift pump. Capacity 750 gallons per minute against 170-foot head.
1	52	900	Geared to bucket hoist, 240-foot lift. Capacity 700 1,200-pound buckets in 8 hours.
1	75	900	Belted direct to an Ingersoll-Rand air compressor supplying air to six 2.5-inch drills.
1	50	1,200	Direct-connected to a Jeansville 750-gallon centrifugal pump, head 175 feet.
1	5	1,800	Belted direct to exhaust fan.
1	3	1,800	Belted direct to exhaust fan.
1	1	1,800	Belted direct to exhaust fan.
1	10	900	Driving booster elevator.

Samson Mining Company, Joplin, Mo. This mine has an average output of 8,931 tons per month.

Total connected horsepower, 320. Total number of motors installed, 6. Average kilowatt-hours per month, 89,691.

Kilowatt-hour consumption for 12 months: January, 99,800; February, 97,800; March, 87,700; April, 72,800; May, 78,800; June, 77,900; July, 68,300; August, 70,600; September, 85,600; October, 120,300; November, 110,000; December, 106,700. Load-factor 51 per cent.

The approximate electrical energy consumption per ton of rock mined is 10.4 kilowatt-hours.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 25 cycles, 2,200 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	100	480	Belted to line shafting driving one 16-inch jaw crusher; one 36-inch dirt rolls; one bucket elevator, 20-inch buckets; one five-cell rougher jig; one set of 24-inch return elevators; one six-cell cleaner jig; one set of 20-inch rolls; one set of 18-inch sand rolls; one 18-foot sand elevator; one tailing elevator, 62 feet high, 20-inch buckets; and one five-inch single-stage centrifugal pump.
1	150	480	Belted to air compressor.
1	15	720	Geared to car hoist.
2	37	720	Each driving bucket hoist.
1	20	1,200	Direct-connected to pump.

Federal Mine, located in Wisconsin, near Galena, Ill. Average output is 100 tons of rock per day from which 12 tons of mineral are realized. There are 25 men employed working 8 hours per day. Pumps operate 24 hours.

Total connected horsepower, 175. Total number of motors installed, 5. Average kilowatt-hours per month, 38,912.

Kilowatt-hour consumption for 12 months: January, 28,990; February, 28,520; March, 30,880; April, 34,790; May, 41,740; June, 42,490; July, 43,420; August, 41,370; September, 45,580; October, 47,730; November, 39,640; December, 41,800. Load-factor, 40 per cent.

Approximate energy consumption per ton of rock mined is 14.9 kilowatt-hours.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts. Motors are of the squirrel-cage induction type.

No.	Horse-power.	Speed R. P. M.	Application.
1	75	900	Belted to shafting driving one 6-cell plunger jig; one 6-cell cleaner jig; one 4-cell jig; one 15-inch jaw crusher; two 4-inch roll crushers; three bucket elevators; and one American Well Works No. 5 centrifugal pump.
1	20	1,800	Direct-connected to 1,250-gallon centrifugal pump, 150-foot head.
1	50	900	Belted to Ingersoll-Rand air compressor, four 2.5-inch drills.
1	5	1,200	Driving exhaust fan.
1	25	1,200	Geared to incline car hoist. One-ton cars. Time of haul 30 seconds.

Zinc Mining Data—Sheet No. 2.

Friel & Phillips Mining Company, Joplin, Mo. This mine has an average monthly output of 2,718 tons of rock and operates 67 hours per week.

Total connected horsepower, 55. Total number of motors installed, 2. Average kilowatt-hours per month, 19,347.

Kilowatt-hour consumption for 12 months: January, 10,580; February, 14,130; March, 17,140; April, 21,400; May, 20,850; June, 22,180; July, 19,570; August, 22,160; September, 17,060; October, 23,730; November, 24,030; December, 19,340.

Load-factor, 64 per cent.

The approximate electrical energy consumption per ton of rock mined is 7.2 kilowatt-hours.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 25 cycles, 2,200 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	40	710	Belted to line shafting driving one 14-inch jaw crusher; one 24-inch dirt roll; two 20-inch bucket elevators, 22 feet high; one revolving screen; one five-cell rougher jig; one six-cell cleaner jig; one five-inch centrifugal pump; capacity 850 gallons per minute; and one tailing elevator 54 feet high.
1	15	710	Belted direct to one Cornish lift pump, capacity 180 gallons per minute against a 96-foot head.

Hurry Up Mining Company, Webb City, Mo. This mine has an average monthly output of 7,000 tons.

Total connected horsepower, 330. Total number of motors installed, 5. Average kilowatt-hour consumption per month, 52,733.

Kilowatt-hour consumption for six months: August, 32,900; September, 50,600; October, 55,700; November, 57,600; December, 52,600; January, 67,000.

Load-factor, 31 per cent.

The approximate electrical energy consumed per ton of rock mined is 8 kilowatt-hours.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 25 cycles, 2,200 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	150	500	Belted to an Ingersoll-Rand air compressor; 165 revolutions per minute, operating at 100 pounds pressure.
1	100	750	Belted to 60 feet of shafting driving one 16-inch Webb City rock crusher; two 30-foot bucket elevators, 24-inch belt; two sets of 36-inch rolls; one rock screen; one set of 30-inch rolls; one 30-foot bucket elevator, 18-inch belt; one six-cell rougher jig; one seven-cell cleaner jig; one 50-foot tailing elevator, 24-inch belt; one five-foot screen; one five-inch American single-stage centrifugal pump; and one 40-foot dummy elevator.
1	15	750	Belted to 30 feet of shafting driving one 2.5-inch American single-stage centrifugal pump; one rotary sand screen; one 25-foot elevator, 16-inch belt; one 16-foot elevator, 16-inch belt; and four Shidge tables.
1	65	750	Direct-connected to a Freeman bucket hoist raising 1,000-pound buckets 170 feet.
1	25	1,200	Direct-connected to a 2.5-inch American two-stage centrifugal pump with a working head of 175 feet.

Frontier Mine, located near Galena, Ill. An average of 250 tons of rock is mined per day and the average amount of metal secured is 30 tons. There are 48 men employed working in three 8-hour shifts.

Total connected horsepower, 330. Total number of motors installed, 5. Average kilowatt-hour con- 71,578.

Kilowatt-hour consumption for six months: Au-gust, 32,900; September, 50,600; October, 55,700; November, 78,970; October, 84,140; November, 84,160; December, 85,460; January, 82,270; February 85,880; March, 78,660; April, 82,110.

Load-factor, 36 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts. Squirrel-cage induction motors are installed.

No.	Horse-power.	Speed R. P. M.	Application.
1	100	900	Belted to line shafting driving one 8-cell rougher jig; one 8-cell sander jig; one 8-cell cleaner jig; one 15-inch jaw crusher; three 4-inch roll crushers; four bucket elevators; and one centrifugal pump, 750 gallons per minute.
1	37	600	Geared direct to 1,200-pound bucket hoist, lift 200 feet in 13 seconds.
1	75	900	Belted direct to a Cornish two-head lift pump, capacity 1,250 gallons per minute against head of 175 feet. Pump operates continuously.
1	50	1,800	Direct-connected to an American Well Works centrifugal pump. Capacity 1,200 gallons per minute against 175-foot head. Used for auxiliary service.
1	75	900	Belted direct to an Ingersoll-Rand air compressor, 80 pounds pressure, supplying air to six 2.5-inch drills.
2	5	1,200	Each driving 10-inch exhaust fan.

Commercial Practice
Management, Rates, New Business

RETENTION OF BUSINESS OF DISSATISFIED CUSTOMERS.[1]

By Thomas F. Kelley.

All company employees whose duties require them to come in contact with the public, whether in answering their telephone calls, receipting their bills, reading their meter or in whatever line of furnishing *electric service* it might be, should always have in mind being courteous and prompt in looking after their wants and ever recognize the fact when a customer does complain, in most cases he personally feels that he has a grievance that requires courteous and prompt attention and with that fact in mind give attention of that nature in such a way that he will realize that his wants or complaints are being attended to promptly. In most cases such treatment of a complaint will alone retain the business.

Of course if our service were always satisfactory, all employees were courteous and all customers' wants were attended to promptly and their monthly bills did not exceed what they thought they should be, we would not have dissatisfied customers. Yet, even in the best regulated families or companies this does not happen, and, therefore, we all have to plan some way to take care of such customers, having in mind the retention of their business.

Customers might possibly become dissatisfied through the *service* rendered from so many departments of a light and power company or through the actions of employees whose duties are entirely different that I will not attempt to tell you what I think you should do in each case, but will suggest what might be done in some cases and in particular to take care of the *complaints* that perhaps come from a cause giving the greatest amount of dissatisfaction, with the idea in mind of retaining the business of such dissatisfied customers who have complained of the size of their monthly account.

I will mention here that instructions should be given to billing clerks that they should use the same caution in sending out an account that appeared to be high, as they do in mailing one that gives the appearance that the meter had stopped, because the expense in checking up the meter reading is a small item in comparison to the trouble and annoyance generally caused by an incorrect bill being rendered.

Complaints as to the size of accounts are generally first made to the person whose duty it is to receipt bills and I would suggest that in answering such a complaint he eliminates statements that I believe we have all heard, such as—"that something might possibly be wrong with the meter"—"that the meter reader may possibly have over-read the meter," or other such statements, because to my mind statements of that nature suggest to the customer that neither the meter reader nor the meter were reliable whereas we all know the small percentage of mistakes made by the usual competent meter reader and the few inaccurate meters. But, rather, let him or the party whose duty it is to take care of such complaints, first satisfy himself that no clerical mistake has been made in making out the account from the records. Providing that no mistake has been made, the matter should then be discussed and by arguments advanced by the central-station employee, politely and convincingly, the customer often can be satisfied. He will then pay his bill willingly and go on his way. However, if it be noted that the customer is apparently not in a receptive mood to discuss the matter and the usual arguments have not satisfied him, tell him quietly that the account will be investigated at once and a report made to him immediately, and then see that the complaint is investigated promptly. That, to my mind, is half the battle —*promptness.*

An order should be made on the Meter Department to investigate the conditions at once and with a competent inspector, many customers can quickly be satisfied. Train this man for the job and see that his inspection is complete. Have a new reading taken of the meter, perhaps this will locate the trouble; if not, test the meter to determine whether it is O. K. If it is a lighting bill in dispute the inspector should not forget to inquire diplomatically what lights are used and for how long, and if in a position to recommend changes in the installation that will give satisfactory lighting and consume less current, do not fail to do so. This inspector should be competent to suggest changes in residence installations and possibly some store installations; in fact, with some companies he necessarily will take care of all, but in the larger cities after it has been determined that the meter is correct, the illuminating engineer or lighting salesman should be called in to see if he can offer the recommendations as to suitable changes in the customer's lighting installation to reduce the cost of lighting to enable the customer complaining to be turned into a satisfied customer.

If it is a complaint regarding a power bill after the meter has been found to be correct, the complaint should then be turned over to some competent employee to ascertain whether some changes could be made in the installation to reduce power costs and transfer a dissatisfied customer into a satisfied one.

How the information contained in the inspector's report should be passed on to the customer is something that has bothered most companies. Some have prepared a personal letter which follows a regular form, others have a competent employee telephone the information while others have the report delivered in person. I, personally, favor the last two and employ the latter one as often as possible. The letter may be nicely worded, and all that, but it does not have the effect of the telephone or personal conversation which enables you to find out just how your customer feels when you have given him the information.

Other complaints which sometimes cause dissatisfaction of such a nature that diplomatic handling of the customer is required to retain his business, are brought about by delay in furnishing service and poor lighting.

Poor lighting is a complaint in connection with the operation of a plant entirely, and when received should be attended to promptly. To retain the business, lines have to be rebuilt and the capacity of transformers often increased, but in many cases a supply of lamps to replace blackened ones will do the trick and where carbons have been used, their substitution by Mazdas.

Complaints from delay in furnishing service are often looked upon by the operating end of the business as being unreasonable. However, if we in the light and power business, will look upon the matter from the customer's standpoint there will be few delays and greater satisfaction. We, personally, know that

[1] Paper presented before the Ohio Electric Light Association, Cedar Point, O., July 16.

when we order anything, a suit of clothes or some article of furniture for our home, although we have done without it for months, perhaps years, as soon as we order it we look for it to be delivered at once; therefore, why should we not supply our service promptly? While on this particular subject I am going to mention some causes for delay in furnishing service and the greatest delay is from the practice of some companies in insisting upon deposits or guarantees. I know of one company who is prepared to furnish service upon receiving a telephone message. Of course they would follow this up by securing a contract and making inquiries as to credit, in most cases being satisfied if the customer did not owe a bill for previous service, but they always secured information as to occupation and where employed, working on the theory that while the customer might move he necessarily would not change his place of employment also. This company maintains an excellent collection bureau and their increased revenue from promptness in delivering a service and general satisfaction more than made up for the few bad accounts they picked up from time to time. And I know of another who insists upon a contract being secured first and then if the applicant had not used light for a year at some other address and had paid his bills promptly, a deposit was required to cover two months' account or a suitable guarantee. This guarantor had to be a property owner and the property had to be practically free from encumbrances. Can you imagine the delays caused in furnishing service in this town—the lost revenue and general dissatisfaction, perhaps not outwardly but inwardly, and the many who would sooner do without the service than to place a deposit or be obligated to some fellow citizen who was fortunate enough to own property? Which way of conducting our business are you in favor of? Which is preferable from the broad viewpoint of greater revenue and public be pleased attitude?

Power Supply for Rand Gold Mines.

The electric power supply to the gold mines of the Rand by the Victoria Falls & Transvaal Power Company is stated to be the largest amount of power supplied to any undertaking in the British Empire, not excepting the Canadian power stations at the Niagara Falls. The standard price in 12-year mining contracts is one cent per kilowatt-hour, as long as the monthly load-factor is above 70 per cent, the load-factor being based on the hour of maximum consumption. This price is subject to periodical revision, depending upon the cost of production.

Developing Central-Station Business at Steubenville, Ohio.

In a paper presented before the convention of the Ohio Electric Light Association at Cedar Point, July 15-18, H. E. Armstrong interestingly outlines the commercial methods adopted by the Steubenville company in increasing its business.

The writer has been in the developing game for the past eight years, and will try to show the way a central station in Ohio built up its load and the diversity in the load in 1911.

The Steubenville & East Liverpool Railway and Light Company supplies Steubenville and Toronto, representing a total population of about 35,000 and in 1911 had 400 consumers on the line and had only 40 horsepower in motors.

On May 1, 1911, we had a Commercial Department installed and went after business. We have today over 1,500 horsepower in small customers, ranging from one horsepower to 100 horsepower, from which we get an average of 3.7 cents per kilowatt-hour.

The development in Steubenville for the past two years from a central-station standpoint has been very remarkable.

Each factory and individual power user was called upon by our power solicitor and a proposition submitted, showing the number and horsepower of motors necessary, cost of installation, and the approximate cost of operation.

The increase in horsepower connected as cited above shows conclusively that our power campaign was more than successful. Especially so, in view of the fact that 95 per cent of power users were operating gas engines at a rate of from 15 to 25 cents per 1,000 cubic feet.

We found that with very few exceptions the gas-engine operator did not keep an accurate account of his power cost, in the majority of cases figuring the gas bill as practically the total power cost; the theory being that repairs to the gas engine were too insignificant to be taken into consideration. Interest and depreciation on equipment was lost sight of entirely.

Any number of power prospects who are now using motor drive could hardly believe their eyes when shown an itemized compartive statement of their present power cost as against motor drive, which not only carried a saving in operation but a very perceptible increase in production.

Some of the most skeptical of these consumers are unanimous in their praise of motor drive and admit that the facts have proven all of our statements with reference to the possibilities of this class of power, which seemed exaggerated, to be absolutely true in every particular.

The average residence prospect, (I say prospect advisedly as we considered every household as such), considered electricity a luxury to be enjoyed only by the rich and beyond the reach of his pocketbook.

The Mazda unit together with the introduction of the flat-rate control instrument commonly known as the Indicator, made it possible for us to instigate a very successful residential campaign, most especially among the middle and lower classes whom we found skeptical of the meter proposition in spite of the comparative low consumption of the Mazda as against the carbon lamp, it being our desire to electrify primarily old residences, in order that our solicitor might be in a position to go into the matter thoroughly and intelligently without making a number of unnecessary calls. The local contractors were invited into conference and a price fixed per room, viz $4.50, including wiring, fixtures (with pull-chain sockets) and Mazda lamps, no switches being furnished except snap switch for porch and cellar lights.

Commercial Campaign.

Our competitor in this field as well as in those cited above is natural gas, which is very plentiful and sold at a rate of 25 cents per 1,000 cubic feet. The majority of our large stores were using gas arcs upon which, figuratively speaking, our guns were immediately trained. Again we found the Mazda lamp effective ammunition and for several months we kept the local contractors on the jump replacing gas arcs with Mazda units.

Not only were we successful in the larger stores, but contracts were secured from the smaller merchants and their places of business electrified.

Window lighting conditions of each business house were studied and each merchant furnished with a diagram of his window, showing wattage and number of lamps necessary to insure proper illumination. Thus over 50 per cent of the store windows were rewired and are now lighted in conformity with our suggestions. The same method was pursued with reference to interior lighting with marked success.

A sign circuit was installed in the business district and a sign campaign inaugurated, in which we solicited the services of several sign companies, submitting to each a list of prospects and always requesting bids from all of them in connection with any sign, thus insuring fair competition and a square deal for the sign companies who send solicitors in the field, and to them is due the lion's share in connection with the success of this campaign.

In the tungsten arc lamp we found another medium for securing business. A number of small merchants not in a position to invest in an electric sign, acting upon the suggestion of our solicitors, have their name or business painted on the globe, making the tungsten arc do double duty as it were, illuminate their front and advertise their business.

The following is a summary of the

business connected before and after our commercial campaign:

	1911		1913	
	No.	K. W.	No.	K. W.
Power Connections ...	3	32	76	1200
Commercial Connections	260	520	604	1208
Residential Connections	240	120	402	201
Flat-rate Commercial Connections.				
Flat-rate Residential Connections.	0		194	19.4
Sign Connections	0		61	41
Tungsten Arcs	0		120	12
White Way Posts....	0		59	23.6
Irons	25	12.5	300	70
Total	528	684.5	1816	2775

Steubenville's "Great White Way" we consider our most notable achievement. The business district is lighted by 59 ornamental standards, of which two are on either side of the Court House entrance, supporing five lamps each, all of 80 candlepower. The top one being on all night, while the remainder burn until midnight. The spacing of the ornamental standards is approximately 85 feet and the lamps are fed through an underground system.

St. Louis Fan Campaign.

The Union Electric Light & Power Company, St. Louis, Mo., is actively pushing the sale of electric fans and present indications point to a record season in this line. Billboard and newspaper space are the principal media used although special posters placed in stores and the company's various offices have brought in excellent returns. The company uses a uniform illustration, in all its advertisements portraying a thermometer registering 90 degrees and a busy fan sending its cooling breezes over a man with a pleased countenance.

The Electrical Vehicle in Great Britain.

Following on the discussion on the subject of electric vehicles at the recent meeting of the British Incorporated Municipal Electrical Association the Council of that body has decided to appoint a committee "to consider and adopt such measures as might be found desirable to further the use of the electric-battery vehicle in the United Kingdom, and that such committee be empowered to co-opt representatives of other institutions, company-owned electric supply undertakings, manufacturers, and others directly interested in this matter."

Central Station Does No Wiring in Chattanooga.

The Chattanooga Railway & Light Company, of Chattanooga, Tenn., does not find it necessary to engage in the installation of electric wiring in houses of any sort whatsoever. House wiring is left wholly to the local electrical contractors.

O. B. Agner has lately succeeded H. B. Darling as general manager of industrial power sales for this company. A prosperous business is reported.

Income From Electric Signs in New York.

An interesting phase of the sign-lighting situation in New York City is revealed in the fact that the New York Edison company obtains five per cent of its total gross earnings of about $20,000,000 from electric signs along the "Gay White Way." The company does 80 per cent to 85 per cent of the business along Broadway from Twenty-third Street to Columbus Circle, and the United Electric Power company gets the balance.

The New York Edison also gets all the electric lighting business, including that of signs and displays, on the lower east side and in the Bronx.

The sign business alone in those two sections of New York gives the Edison company another five per cent of gross revenue.

In the aggregate, operating revenue of the New York Edison Company from the sign business approximates $2,000,000 annually.

The net profit from such business is proportionally greater than that of any other field covered by the company. In other words, 10 per cent of operating revenue from the sign business means considerably more than 10 per cent of the net revenue. In consequence the Edison company has a large staff paying exclusive attention to the development of the use of the electric sign.

The company gets most of this profit from the smaller signs, which use so little current that they do not obtain the wholesale rate. Close estimates are that the smaller signs, on a retail rate, provide 70 per cent of the gross earnings from the sign business. The large spectacular and flashing signs get the wholesale rate and give the Edison Company an average of $5,000 or less gross revenue per annum. The "Chariot Race" provides the largest single item of sign operating revenue—about $6,000 per year.

Electric-Vehicle Advertising in Boston.

One of the conspicuous advertisements that have been placed in Boston newspapers at intervals during the past six months by the Electric Motor Car Club of Boston, advertising electric pleasure cars and trucks, represents a horse tied to the tail-board of an electric commercial vehicle. The animal's figure is vaguely outlined, giving point to the inquiry that heads the advertisment, "Has the horse a *ghost* of a show?"

The advertisement states that the large express companies are fast substituting the electric truck for horse-drawn vehicles, the American and National Companies now having 42 electric wagons in use in Boston, with more ordered. The Edison Electric Illuminating Company of Boston has just ordered 22 more electrics, which include 11 2-ton trucks, two 1,500-pound and nine 1,000-pound trucks to add to their already large fleet of electrics.

The General Electric Company now operates 26 electric wagons in this territory. Other extensive Boston users of this modern transportation facility are the John E. Cousens Coal Company, the Pureoxia Company, Massachusetts Breweries, Thompson-Norris Company (manufacturers of pasteboard boxes), Staples Coal Company, A. J. Houghton & Company (brewers), and the National Fire Proofing Company.

Eleven agents for electric commercial vehicles and ten agents for electric passenger automobiles share in the expense of this co-operative advertising, for which more than $1,000 has already been spent.

New Home for Rockford Electric Company.

Work is rapidly progressing on the new office building for the Rockford Electric Company and it is expected to be ready for occupancy by July 28. The company's new home is located at 116 South Wyman Street and will provide ample space for future growth of the company.

The building is three stories high and receives natural light from three sides. The entire first floor, measuring 45 by 85 feet will be utilized for offices and displaying rooms. A feature of the arrangement is the absence of private rooms or partitions, the entire floor being visible from any part of the office. In the center of the room, along the South wall, will be a slightly raised platform, where the general manager's and commercial manager's desks will be located. Thus the manager or the new business manager will be accessible to the public at all times, which is in accordance with the "open-door policy" of Adam Gschwindt, manager of the Rockford Company. Lighting of the offices is taken care of by 18 400-watt Mazda lamps.

The second floor of the building will contain a meter laboratory, store room, engineering department, and a meeting room, which will also be at the disposal of civic bodies desiring a gathering place.

An electric sign, 20 feet high and containing 800 five-watt lamps is being built and will be erected on the front of the building.

Electric Signs in Evansville.

Two large electric signs have recently been installed in Evansville, Ind. One of these is for the Evans Brewing Company and represents a beer bottle 20 feet high pouring a 21-foot stream into a glass.

Electrical Construction

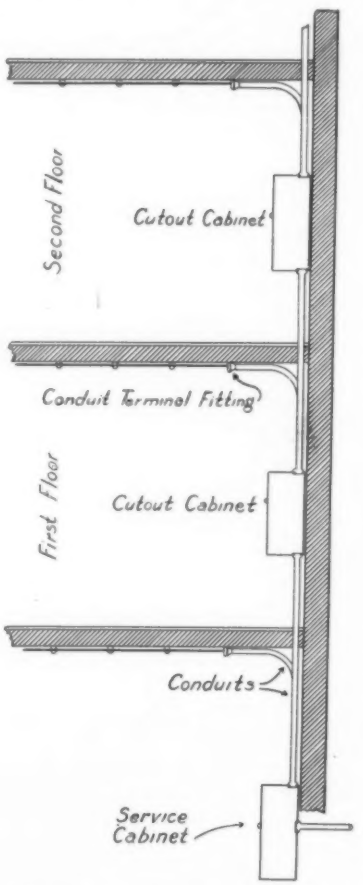
REPAIRING SOME HAZARDOUS WIRING.

By H. G. Wilson.

From the standpoint of the insurance company the hazard introduced by defective electric wiring is determined very largely by the class of risk in which the electrical installation happens to be. If, for example, the building happens to be one of fireproof construction and the contents of it are of a non-combustible nature, the insurance company can usually afford to assume the risk without giving the wiring nearly so much consideration as would otherwise be necessary. On the other hand, where hazardous processes are carried on in buildings of the ordinary type of construction, the fire hazard of poor wiring must be given very careful attention; here, in fact, defective wiring may lead to a positive rejection of the risk, unless the property owner takes proper steps to have the defects remedied.

In a case which the writer has in mind there was a brick building, of semi-mill construction and having five stories and a basement, which was occupied by a feed store and by certain varnish and lacquer factories, the feed store, with its stock of hay, etc., occupying the basement and first floor and the varnish factories being located on the floors above. Initially the whole wiring installation in this building consisted of the usual sort of open work; that is, circuits run exposed, key sockets, open-type direct-current motors, etc. It is easy enough for the reader to see that after a few years of use, with the customary lack of attention to proper maintenance, electrical work of this kind in a building used as this one was constituted one of the most serious hazards that the fire underwriter has to consider in carrying the risk. In fact the hazard was so great that a prompt revision of the wiring had to be insisted upon. The following notes indicate the changes that were made.

A complete conduit system was very desirable here, but the objection was made that there was a lack of funds to put one in. So the open service entrance was replaced with cables run in conduit and approved fittings to the main meter board and cutout cabinet. This cabinet, being of necessity placed in the cleaning department of the feed store, was built with a view to making it entirely dustproof. In order to insure dust-tight contact at all points between the cabinet and the door, a piece of felt about an inch wide was used as a strip around the inner edge of the door, the strip of felt being attached to the shutter. Also, the meter loops were placed in conduits equipped with suitable fittings.



General Arrangement of Circuits.

From the main cutout cabinet the circuits needed for power and lights on the several floors were run in a conduit riser which was carried up in the shaft occupied by the front stairway. On the wall at the stairway landing on each floor a cutout cabinet was installed for serving this particular floor, the cabinet being placed, in each instance, directly opposite the door of the room to be served. The circuit to the room was brought out of the cabinet in a conduit which extended up to the ceiling and terminated there in a standard terminal fitting, as shown herewith. From this point on the wiring was run open to the various lamp and motor locations. Special attention was given to the installation of the open wiring, strong guards and running boards being placed wherever there was any probability of injury to conductors from belts, the storage of boxes, etc. Moreover, approved keyless sockets were supplied for the lamps, aand standard inclosures for the motors and motor-control units.

The diagram herewith illustrates the arrangement of the circuits, although only two floors and the basement are included in this figure. It should be added that the cutout cabinets on the different landings are installed within easy reach of the floor and that they contain the necessary fuses and switches for the control of the circuits.

Thus it will be seen that a convenient means is provided each tenant for disconnecting all the current from his floor as he is leaving the building at night. When the building is finally vacated for the night, no current at all is left on the open wiring; the conductors in the grounded conduit system are the only ones left alive then, and, these being in the hallways, the previously always present danger of live drop cords being left in contact with inflammable material, or of lighted lamps on extension circuits being thus left was removed. The improvement in the system is most marked.

The Douglas Electric Construction Company.

One of the most popular electrical contractors in the Southland is Roydan R. Douglas, president of the Douglas Electric Construction Company, Limited, of New Orleans. Mr. Douglas has been prominently identified with the electrical contracting business in the South and has been conspicuous for his activity in the electrical contracting organizations and in their conferences with the other ele-

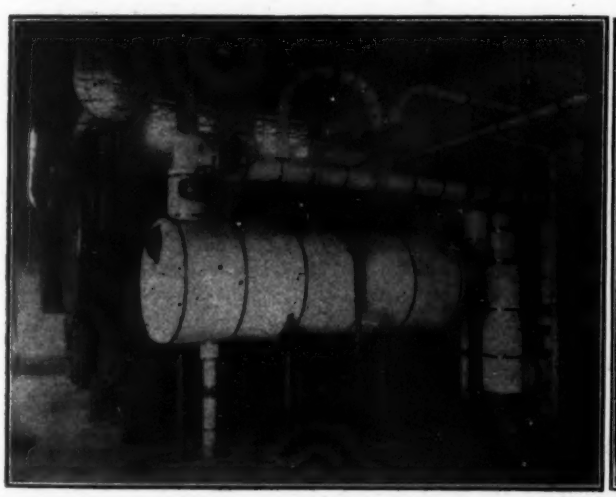
A Street in Plaquemine, La.

Power House.

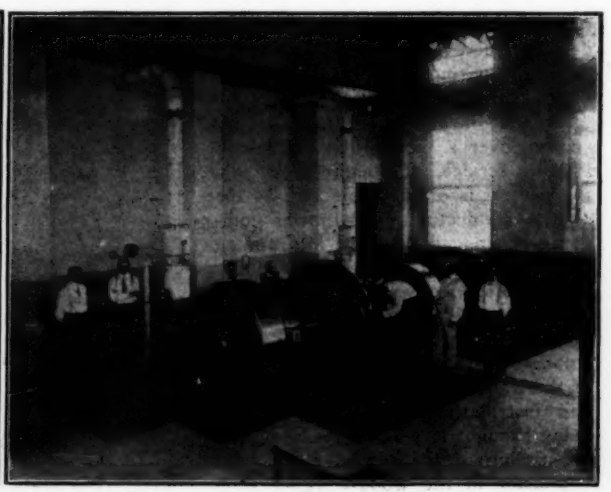
ments in the electrical business. The Douglas Electrical Construction Company has installed electrical equipment in a number of prominent places in the South, notably the electric light plants at Vidalia, Miss.; Laurel, Miss.; Woodville, Miss.; Ruddock, La.; Donaldsonville, La.; Plattenville, La.; St. Patricks, La.; Bowie, La.; Plaquemine, La.; Lobdell, La.; Gibson, La.; McHenry, Miss.; Washington, La.; Jeanerette, La.; Clarks, La., and a number of factories, residences and stores at New Orleans and other places. The company has recently finished the lighting plant at Melbourne, Fla., and is now building an electric light and water works for the Le Mar Lumber Company, Clyde, Miss., and has recently received a contract from the United States Government for the electrical system to be installed at the United States Marine Hospital at New Orleans.

An interesting equipment which was installed by the Douglas Electric Construction Company is the oil-burning plant of the Dunlap Electric Company at Plaquemine, La. This installation is typical of the modern plants now being erected in the south to serve industrial communities of from 5,000 to 10,000 inhabitants. The installation was described in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of November 23, 1912, when it was erroneously stated that the electrical equipment was installed by Henry Widmer, of New Orleans. The power house is a fireproof structure of pressed brick, steel and concrete, 54 feet by 70 feet. The engine room and boiler room are separated by fireproof partitions and fireproof doors. The boiler equipment consists of two 72-inch by 18-inch horizontal return tubular boilers, two 6.5 by 4.125 by 8-inch Blake boiler-feed pumps, and one open and one closed heater. The water supply for the entire plant is furnished by a Deane duplex pump from a six-inch well 180 feet deep to a 10,000-gallon tank at an elevation of 50 feet. The boiler feedwater is automatically controlled in each boiler by Berry boiler-feed regulators. Oil is used as fuel in each furnace by means of Higgins burners. The generating equipment consists of two Bullock alternating-current generators of 100 kilowatts and 65 kilowatts capacity respectively. These are three-phase, 60-cycle, 2,300-volt generators, and are direct connected to Skinner automatic engines.

Roydan R. Douglas.



Boiler Room.



Dynamo Room.

THE ELECTRICAL INSTALLATION IN AN INDUSTRIAL-SCHOOL BUILDING.

Equipment for Lighting and Power.

There is perhaps no class of buildings in which greater care is necessary in the design and installation of the electrical work than in the school building. For instance, the wiring in any building of this sort ought always to be as free from the fire hazard as electric wiring can be made; in recognition of this fact, only conduit construction or armored-cable work is permitted in many of the cities for school buildings. The old haphazard methods of illumination, moreover, have no place here. There should be the best possible daylight illumination, and, at the same time, the artificial lighting should be of the highest quality. Where power circuits are to be installed they should be put in with a special view to convenience as well as safety.

Unfortunately, notions of economy very commonly make it impossible to secure these requisites in the proper degree in the electrical work in the public-school building. This condition probably had to be contended with more or less in the design of the electrical work for the Industrial Arts Building recently erected by the Board of Education in Rock Island, Ill. At any rate, there was no intention to make the installation needlessly elaborate; simplicity and efficiency were the aim of the engineer who designed it. How well he realized this aim is indicated in the notes that follow.

The building in question is a three-story fireproof structure, and the dimensions of each floor are 112 by 112 feet. It is to be used as an industrial or trade school. Hence the electrical equipment includes a number of motors. Moreover, it was necessary in the design of the lighting to make sure that this was of a kind suited to the needs of the evening classes.

All the wiring for lights is in concealed conduits. Current is supplied from the lines of the local central station, over a three-wire 110-220-volt lighting service. Throughout the job, the neutral is of the same size as the outside conductors. The power company's mains are brought in from an alley at the north end of the building. The service wires consist of three No. 1 B. & S. gauge conductors run in a two-inch conduit which extends from where the wires reach the outside of the wall to the main lighting switch and distributing cabinet, the service being brought in about on a level with the ceiling of the second story. On a pilaster in the wood-working shop on the second floor the main lighting-service panel is located. This is a slate panel, inclosed in a surface-type steel cabinet, the cabinet having wiring gutters and being provided with a door equipped with lock and key. The service switch, which is mounted on this panel, is a three-pole single-throw unit with the handle end fused in the outside wires; the neutral is not fused. There are four three-pole single-throw switches on this board, which control the mains to the distributing panels. The main switches are fused on the hinged end. The service board also has the central-station company's meters mounted on it.

One set of the mains mentioned consist of three No. 6 wires in a 1.25-inch conduit; two other sets of three No. 8 wires in one-inch conduit; and a fourth set is made up of three No. 4 conductors run in 1.5-inch pipes.

Each of the four distributing cabinets, with which the lighting mains connect, contains a slate panel arranged for three-wire feeders and two-inch branch circuits. These have lugs only in the feeders. Three of the panels

Fig. 1.—Daylight View of Drafting Room.

Fig. 2.—Night View in Drafting Room.

have plug fuses and knife switches in the branch circuits, while the remaining one is equipped with cartridge fuses and 50-ampere knife switches. All the

Fig. 3.—Portion of Forge Shop Seen By Daylight.

panels have wiring gutters and are inclosed in flush-type steel cabinets with steel door and trim, each fitted with a lock and two keys. Within the wiring gutters of the cabinets the conductors, including the mains, are

Fig. 4.—Night View in Forge Room.

covered with non-metallic flexible tubing—or "loom," as wiremen know it.

What we may call cabinet *A* supplies the lamps on the first floor and has 14 branch circuits; cabinet *B* has 12 circuits and supplies the lamps on the second floor; from cabinet *C*, 10 circuits are run, which supply lighting current to the lamps in the third story; and cabinet *D* supplies the heavy plug outlets in the lecture rooms, workshops, etc., there being six circuits from this panelboard.

In the running of lighting circuits, the practice of placing outlets situated in two or more different rooms on the same circuit was avoided as far as possible, and hallway lamps were always kept on circuits separately from those accommodating outlets in the rooms, of course.

Floor outlets were provided wherever these were likely to be needed. These were equipped with Fullman adjustable water-tight floor boxes, complete with flush brass cover and flush plug and bell nozzle.

Switches of either the push-button flush or of the indicating snap-switch type were installed wherever they are needed for the control of the various outlets. As is customary, the finish of the flush-switch plates was made to match the surrounding hardware.

Special pains were taken while roughing-in the job under consideration to set all switch boxes flush and plumb, so that the wires would be properly protected and the switch plates could easily be set true. Care was also taken to fulfil all other such Code requirements as the reaming of conduits, the proper use of outlet boxes and plates, bushings and locknuts, etc.

The lighting fixture installation in the Industrial Arts Building was designed and put in by the electrical contractors who did the wiring, these being the Electric Construction & Machinery Company, of Rock Island. This firm, it may be explained in passing, was a pioneer among electrical contractors specializing in tungsten illumination and keeping a lighting specialist regularly on its staff. The accompanying photographs are views which bring out some of the typical features of the lighting. The fixtures in the workshops, and in the boiler and engine rooms are chain pendants, with chain ends both at the canopy and at the reflector holder. From outlet to socket connection is made with black fixture wire. In lecture rooms, halls, etc., single-unit fixtures made of brush-brass oval links, and having brush-brass canopies and holders, are employed. The canopies are insulated from the ceiling with standard insulating rings. These particular fixtures are wired with yellow silk-covered flexible cord.

While it would seem that there was perhaps an unfortunately large amount of exposed incandescent filament in the illumination, as the figures show, it is very much superior to what one commonly finds in public-school buildings.

Motor Wiring.

A separate service is provided for the motor installation in this building, the motors being connected to a 440-volt, two-phase, 60-cycle circuit, brought in from the central-station company's lines. A motor-service panel is installed on a pilaster on the second floor, not far from the main lighting-service boards.

The motor service panel is installed

in a surface-type steel cabinet. The brushes are on the front of the panel. The equipment here consists of the four-pole, single-throw, 100-ampere service switch, four sets of branch-circuit fuse holders, and connections and space for the central-station company's watt-hour meter.

The wiring to the motors is run in exposed conduits, and, as already intimated, there are four circuits from the service to the various motors. The motor conduits were run in straight lines paralleling the walls, and wherever possible the runs in the same direction were grouped. Where this could be done, the conduits were fastened to the ceiling with pipestraps, and in places where this sort of construction was impossible, it was supported every six feet with figure *8* iron chains fastened around the conduit with adjustable pipe hangers and to the ceiling with solid inserts. No pains were spared, in short, to make this exposed work look neat.

Concrete Services Boxes.

The wooden service or distribution box possesses several disadvantages both on the score of insecurity from fire and liability to mechanical damage. On the other hand, its usual substitute—an iron box—has the drawback, especially on the three-wire direct-current system, of assisting any trouble that may arise owing to a blowing fuse arcing on to the earthed box, and so short-circuiting the system. In the large majority of cases such a disaster is unlikely to happen with the modern type of inclosed fuse, but there are cases where a heavy short-circuit causes the fuse to blow with explosive violence.

A concrete service box has been designed by W. A. Brown, distribution engineer of the St. Pancras Electricity Department, in London, England, and described in the *Electrician*. St. Pancras has a three-wire direct system with the neutral grounded. Serious fires have several times broken out owing to a short-circuit following the blowing of a fuse

The standard service box is divided into three divisions, the outer two being for the positive and negative cables respectively, and the large inner division for the neutral. The vertical sides of these divisions are provided with two horizontal slots into which fit two cast-iron plates. These plates are traversed by two screw iron rods which maintain the plates at a constant distance apart. The fuses used are of the Zed type and are kept in position between the cast-iron plates by a special screw and plate which is insulated by a porcelain bush and rubber ring. The lid of the box is fitted with three thin glass plates, which not only allow the state of the fuse to be seen, but act as a safety device in case of a dangerous rise of the pressure inside the box. It has been found that these boxes have given great satisfaction, and they are now being adopted as standard by the department. It should be mentioned that special sealing-in boxes are used which allow the service to be brought in either at the bottom or sides, while extra units can be added as desired where a consumer increases his load.

The Inspector and the Contractor.

At a recent State convention of Minnesota firemen the chief of the fire department of one of the smaller cities of the State complained that the attitude of a good many electricians in the work of installing electrical equipment in a building still is that the inspector is his natural enemy; and this is the case whether the inspector is the one employed by the municipality or the one who is doing the work for the insurance people. In either case, the electrician takes the position that the inspector is there to find fault. As a practical man, he has a pronounced contempt for the theorist who does not wear overalls, and questions his ability to point out defects in a practical man's work. This attitude, however, has largely disappeared in the larger cities, where the problem has been handled in the proper manner. The contractors, especially those of the more intelligent kind, understand perfectly the necessity for careful supervision of electric wiring from the fire-prevention standpoint, and are entirely willing to abide by the rules issued by the underwriters' boards for their guidance.

Lighting of Motorcycle Track at Newark, N. J.

There has recently been completed the installation of a lighting system for the new motorcycle track at Newark, N. J., which involves a number of features out of the ordinary and which, therefore, should prove of interest. This track is one-fourth mile in circumference. It was intended to use this track frequently for racing at night, and therefore special plans were made for its illumination, at first by means of flaming-arc lamps When the actual installation was made, however, it was decided to use 500-watt Franklin tungsten lamps for the track itself. The lighting is done by means of 50 lamps of this size, each equipped with a 20-inch enameled reflector. The lamps are suspended from a two-inch iron-pipe gooseneck, extending six feet over the track and of such a height that the bottom of each lamp is 19 feet above the track surface. These goosenecks or booms are supported from the edges of the bleachers and grand stand and are swiveled so that they may be swung in for renewing or cleaning of the lamps and reflectors.

The lighting of the track in this manner has been very successful. There is not a shadow on the entire track. The riders, some of whom have driven all over the principal tracks in the country, claim that it is the best lighted track they have ever seen; the particular feature emphasized by one of the riders, in commenting on the lighting, is that the track is so well lighted that it seems more like daylight riding than riding at night.

The arrangement of feeders which control this lighting is somewhat novel. There are four three-wire main feeders starting from the judges' stand, where there are located 100-ampere triple-pole double-throw fused terminal switches; double-throw switches were used so that in the event of the main fuses blowing the switch can be instantly thrown over and the circuit immediately put in use again without making it necessary to hunt up the electrician to fuse the switch. A further measure of precaution consisted in alternating the lamp groups as follows: feeder No. 1 controls 12 lamps, including 1 to 6 and 13 to 18; feeder No. 2 controls lamps 7 to 12 and 18 to 24; the other lamps are similarly grouped. This arrangement was followed so that if a main fuse blows it involves cutting off current from only a few sections of the track at one time. Since motorcycle racing is at a speed of a mile or more a minute, these extra precautions were necessary to insure adequate lighting under all circumstances.

From the mains feeders for each of the individual lamps were taken through a double-pole main-line switch and cutout incased in a steel box. As these switches and cutout boxes are beneath the track itself it was necessary to number each box and to hang a corresponding number from the lamp, in order that their designation might be instantly known.

In the center of the field there is a large octagon-shaped band stand illuminated and decorated by means of streamers forming a May-pole effect; for this purpose 200 Pass & Seymour streamer receptacles are used. The grand stand is illuminated by means of 30 150-watt Franklin tungsten lamps, each located in the center of a bay. The automobile driveway, the trainers' quarters and passageways throughout the grounds are lighted by means of about 350 tungsten lamps, ranging from 60 to 100 watts each. The outside arena and automobile storage is illuminated by means of four flaming-arc lamps controlled from the ticket office on a separate circuit. All

stairway lighting and exit lighting is also controlled from the box office.

Current is supplied by the Public Service Electric Company, which extended its primary circuit direct to the meter room, where there were installed two 1,000-light transformers for the track lighting. The secondary circuit is 115 volts and the supply is 60 cycles. The extreme voltage drop in the lines is four volts to the opposite end of the track when the entire arena is lighted.

The design and layout of the electrical equipment was left to the Davis Electric Company, of Newark, N. J., which engineered and installed the entire equipment.

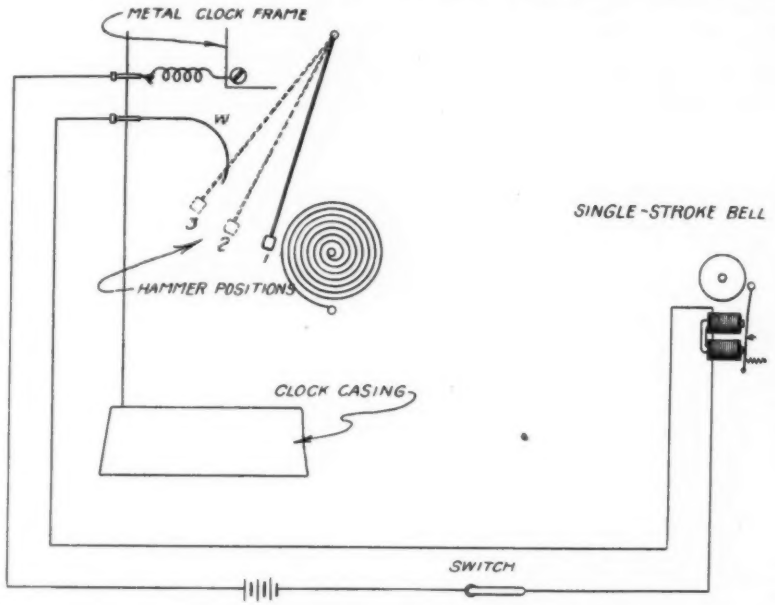


Diagram of Connections of Striking Clock.

Extending the Radius of a Striking Clock.

The accompanying drawing illustrates a simple method of attaching an electric circuit to the striking mechanism of an ordinary kitchen clock to operate a single-stroke bell at a distance on a battery of three cells. The arrangement consists of a flexible bare copper wire *W* attached to a common screw in the clock case in such a manner that when the hammer rod swings back to position No. 3 furthest away from the clock spring gong, it will establish a momentary contact through the brass frame of the clock and enable current to flow through the bell magnets. In the type of clock in which this connection was used the hammer gradually swung outwards to position No. 2 on the half-hour strike service and it was found necessary to place the wire *W* far enough away from position No. 2 to avoid contact during the advance of the hammer. On the hour the hammer was lifted by the clock mechanism to position No. 3, and there was not the slightest difficulty in transmitting the signals to the bell. It was not considered disadvantageous to transmit only the hourly striking as the half-hour signals in the night were meaningless as the clock itself without a light.

Free Inspection in Chattanooga.

Chattanooga, Tenn., is one of the progressive cities in which there are no charges for electrical inspection. Moreover, the city inspection of electric wiring is such that it is usually accepted by the fire underwriters without question.

J. T. Dugger is the city electrician, under whose direction all inspections are made. Mr. Dugger is a strong advocate of conduit work, and is vigorously pushing a movement now to prohibit any other sort of wiring within the fire limits of Chattanooga.

Among the Contractors.

W. A. Ward, a leading electrical contractor of Asheville, N. C., has just completed the rewiring of the Battery Park Hotel, in that city. This hotel, which is one of the best known hostelries in the Southern States, was built at a time when conduit wiring had probably not been heard of. In the recent rewiring the entire job was put in conduit, the work having been done during a general repairing of the building. Mr. Ward also installed 20 ornamental tungsten lighting standards on the hotel grounds. The posts are of an unusually attractive design, and the wiring was run in rigid galvanized conduit laid in the ground.

The United Electric Construction Company, Philadelphia, Pa., has been awarded the contract for electric lighting, power, wiring, telephones, engines, generators, and complete electrical equipment for the Kenilworth apartment house, situated on the southeast corner of Nineteenth Street and Rittenhouse Square. The National Biscuit Company has awarded to the same company the contract for the entire electrical equipment for its new building to be erected at Thirteenth and Clearfield Streets.

A recently established electrical contracting business is that of Deacon, Van Buskirk & McVittie, in Windsor, Ontario.

The Hawkins Electric Company of Springfield, O., has been awarded the contract for wiring and fixtures in the new high school at Xenia. This is a conduit job with 100 outlets and semi-indirect fixtures are to be installed, as well as a vacuum-cleaning outfit. The same company has the contract for a new fireproof theater and office building with a modern system of ventilation.

The Terrell-Hedges Company, of Chattanooga, Tenn., has recently completed the electrical work in the Signal Mountain Inn, a large summer hotel on Walden's Ridge, near Chattanooga. Another important installation lately finished by this company was the White Way on Market Street, Chattanooga.

A. D. McVean, electrical contractor of Pontiac, Mich., was recently awarded the contract for the entire electrical equipment of the new Pontiac High School. This work, which is now under way, will be a high class conduit job throughout and the school is expected to be ready for occupancy in September, 1914.

H. O. Weeman has recently established an electrical contracting business at 5 Cottage Grove Avenue, Highland Park, Detroit, Mich.

The Beaver Electric Construction Company, of Chicago, will do the electrical work in the new Central Terminal Station, in Chicago, which will include 3,000 lamps and some 300 horsepower in motors.

Enforcing Licenses in Minnesota.

The state commissioner of labor in Minnesota must enforce the laws regulating the examination of electricians and the employment of apprentices, according to a decision by the attorney general, Lynden A. Smith. While the examinations are conducted by a special board, the commissioner of labor is required to see that working electricians are properly licensed.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

Using Step Ladder on Very Smooth Floors.

It happens at times that a wireman has to use a stepladder on very smooth floors, such as are found in dance halls, to make repairs. To prevent the ladder from slipping on such floors the bottom of the legs should be thoroughly covered with friction tape. Where a larger job is to be done a frame should be built large enough for the ladder to be screwed to it, and the bottom provided with rollers, which makes it easy to move the ladder without doing damage to the floor.

Joseph Braith.

A Special Insulation for Wire.

An electrician often finds that he could use an enamel wire to good advantage. The following formula for enameled wire will be found useful for those using iron and other wire for resistance purposes. This insulation has a high dielective strength and the wire can be bent without breaking the enamel.

The compound should be composed of the following solution: (*a*) 10 parts of celluloid dissolved in 250 parts of wood alcohol; (*b*) 50 parts of shellac dissolved in 250 parts wood alcohol. The compound should consist of 50 parts by volume of solution (*a*) and 10 parts by volume of solution (*b*). The desired amount of coloring solution must be added and the whole diluted with 40 parts by volume of wood alcohol.

To insulate the wire draw it through the solution so as to leave a thin film of compound evenly spread over it and pass through a hot blast hot enough to dry the insulation, but not enough to change the permeability in case of iron wire.

H. E. Weightman.

Sawing Carbon.

In working bulk carbon into brushes, contacts, etc., by the use of a hacksaw it is sometimes hard to saw straight and rapidly. By taking a dull blade and grinding it on a half-round emery wheel to a scalloped edge, an effective and inexpensive blade may be had that will cut rapidly and outlast several ordinary saws. Fig. 1 shows the saw blade, and the teeth may be as far apart and as deep as desired. It is not necessary to space them accurately.

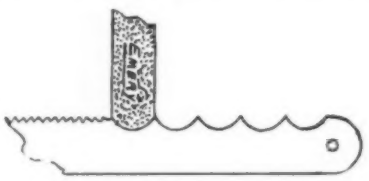


Fig. 1.—Blade for Sawing Carbon.

Robert Oster.

Bending Conduits.

I do not consider the device for bending conduit described by F. J. Neenan, in the issue of May 24, very practical. To secure lag screws and fit timbers with rounded ends on walls and the like requires entirely too much time.

I simply take a thick board, 6 to 10 feet long and bore a hole in this somewhat larger than the pipe to be bent. I place one end of this timber on a trestle bench or something of the sort, and proceed with the bending as shown in Fig. 2. If the board is not thick enough, I reinforce it by nailing a block on either side of it, near opposite edges of the hole.

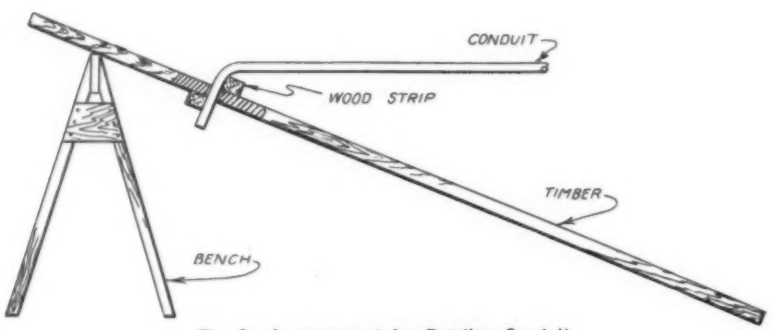


Fig. 2.—Arrangement for Bending Conduit.

Jack Robinson.

Hanging Short-Stem Fixtures.

I have read several kinks in recent issues of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN containing suggestions in regard to hanging short-stem fixtures, and I should like to express my views on this subject. Experience has taught me that no matter how careful a workman may be in screwing the stem to a crowfoot already fastened in place, he will twist the wires to some extent, and thereby damage the insulation. This injury to the insulation, occurring right against the ceiling and concealed by the canopy, frequently becomes a source of danger.

If the stem of the fixture is too short to permit of screwing up in the usual way, I think the safest, as well as the quickest way to install such fixtures, is by using the two-piece crowfoot. After screwing the base of this crowfoot to the ceiling and the other half to the fixture, it is a very simple matter to couple them together without twisting the wires or injuring the insulation in any way. The difference in the cost of this crowfoot over the cheaper kind is more than offset by the time saved in installing.

A. A. Cunningham, Jr.

Outside Lamps on Brackets.

I have found that a most convenient and practical way of setting outside exit lamps for theater or other public building where goosenecks and similar supports under more or less strain are used is to take the ordinary round or square outlet boxes, and, instead of the short screws, supporting the fixture stud, use four two inch stove bolts, turning the nuts up so as to fasten the stud, use four two-inch stove bolts, maining long threaded ends wrap some lathers' wire giving the cement or mortar a fine attachment to cling to when the box is connected and plastered or cemented in position flush with the surface. I have put up many this way with never a complaint of the box becoming loose, as often happens with a wood back that shrinks up when dried out.

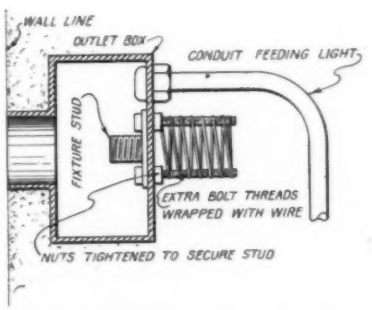


Fig. 3.—Method of Setting Outside Lamps.

Morris Morriarty.

Bridge River Hydroelectric Project.

The Bridge River Company, which was recently incorporated at Vancouver, B. C., has applied to the British Columbia provincial government for water rights aggregating 100,000 foot-acres in the Lillooet district on Bridge River for developing at least 200,000 horsepower, at a cost of $8,000,000. A large dam would be built and the water carried through a three-quarter-mile tunnel to Seaton Lake, where the power plant will be built. The company has taken into consideration the future requirements of Greater Vanvouver and the possibility of electrification of the coast section of the Pacific & Great Eastern Railway, which is to run north from the Pacific coast of British Columbia, to connect with the Grand Trunk Railway at Fort George. The proposed power line will follow the route of the Pacific & Great Eastern Railway for about 150 miles. As the power house will be less than 50 miles from the main lines of the Canadian Pacific Railway and the Canadian Northern Railway at Lytton, the projectors hope also to be able to sell motive power to these two roads. Work is expected to begin on this project before the end of this year and will take probably three years to complete.

Electrical Supply Jobbers' Fall Meeting.

The fall meeting of the National Electrical Supply Jobbers' Association will be held at the Clifton Hotel, Niagara Falls, Canada, September 8, 9 and 10.

Tentative arrangements are being made to have a special train run from Chicago and from New York, and sessions will be held each morning and afternoon on Monday, Tuesday and Wednesday. Arrangements are in charge of Franklyn Overbagh, 411 South Clinton Street, Chicago, who will receive reservations.

Public Service Commissions

CALIFORNIA.

The Railroad Commission has granted permission to the Southern California Edison Company to issue stock to the amount of $3,000,000, the money to be used in the extension of the company's system.

MAINE.

The Public Utilities Act of Maine will not become operative at once on account of the fact that petitions have been filed with the Secretary of State asking for a referendum on the measure. A vote may be taken in November of this year or later, providing the Governor calls a special election; otherwise the measure cannot be voted upon until September, 1914, when the regular general election takes place.

MASSACHUSETTS.

The new Public Service Commission of Massachusetts has organized, with Frederick J. Macleod, formerly chairman of the Railroad Commission, as its chairman. The board voted to retain Charles E. Mann as secretary and Allan Brooks as assistant secretary, they having held these positions under the Railroad Commission, which is superseded by the Public Service Commission. The new board entered upon its duty July 1, 1913.

Forrest E. Barker, chairman of the Board of Gas and Electric Light Commissioners of Massachusetts, has been re-appointed by Governor Foss.

A hearing was held at Northampton, Mass., by the Gas and Electric Light Commissioners of that state, July 11, on the subject of prices of electricity in that city. It was shown that the average prices paid for electricity in Northampton were, per kilowatt-hour; for street lighting, 7.2 cents; commercial lighting, 10.44 cents; power, 3.82 cents; sales to other companies, 1.5 cents. It was urged by an expert employed by the city that the rate charged for power is too high, and the following average rates in other cities of the state were presented: Gardner, 1.6 cents per kilowatt-hour; North Adams, 2.1; Greenfield, 2.3; Pittsfield, 2.4; Springfield, 2.6

A petition has been received by the Commissioners in which several citizens of Newburyport ask for a reduction in the prices charged for commercial lighting in that city.

NEW YORK

Acting on the request of Chairman McCall of the Public Service Commission for the First District, the New York Edison Company, the United Electric Light and Power Company and the Edison Electric Illuminating Company of Brooklyn have notified the Commission that on August 1, they will reduce the price of tungsten lamps in accordance with a recent reduction announced by the manufacturers of such lamps, and will also provide for free renewals of tungsten lamps of 100 watts and over.

The Appellate of the Supreme Court handed down a decision by unanimous vote dismissing the appeal of the Brooklyn Rapid Transit and subsidiary companies from an order of the Public Service Commission requiring the Brooklyn roads to equip the cars on the system controlled by them with power brakes and hand-geared brakes. The companies objected to the order compelling them to modernize their equipment and sued out five separate writs of cerioriari to review the Commission's action. Each of the writs was dismissed yesterday and a total of $50 cost assessed against the Brooklyn Rapid Transit Company. This victory in the Appellate Division follows a two-year fight of the Public Service Commission to compel the Brooklyn roads to supplement the old-fashioned hand brakes with the modern power brake.

A reduction in the price of gas from $1.00 to 95 cents per 1,000 cubic feet has been ordered by the Public Service Commission for the First District in the thirty-first ward of Brooklyn, supplied by the Brooklyn Borough Gas Company.

INTERSTATE COMMERCE COMMISSION.

A decision of the Commission referring to the establishment of through routes and joint freight rates for electrical railways, made on May 29, has just been made public. This is the first time in the history of the Commission that it has passed upon a case of this kind, in which only interurban electric lines are involved. The complaint was filed by the Louisville Board of Trade against the Indianapolis, Columbus & Southern Traction Company and other roads in adjacent territory.

MARYLAND COAL.

Production in 1912 Shows Advance of Nearly 300,000 Tons—Approaching Exhaustion of the "Maryland Big Vein" Stimulates Mining of Smaller Beds.

Maryland's coal production has been fairly constant for the past 15 years, and during that period it has averaged about 4,860,000 short tons. The maximum output was 5,532,628 tons, in 1907. The production in 1912 was 4,964,088 short tons, valued at $5,839,079.

The coal deposits of Maryland are confined to a small area in the two western counties of the state, Allegany and Garrett.

Technology Research Laboratory.

An electrical research laboratory has been established at the Massachusetts Institute of Technology, Boston, under the direction of Harold Pender, with H. F. Thomas as assistant director and secretary. The official title of the bureau will be the Division of Electrical Engineering Research.

The work is endorsed by a grant of $10,000 a year for five years from the American Telephone & Telegraph Company, President Vail having recently secured an appropriation of that amount by the company. Besides this fund there are further gifts and promises amounting to more than $150,000 with which the Institute will conduct electrical work. The funds given by the telephone company carry no control over the manner in which the research work along electrical lines shall be conducted. This is left entirely to the authorities at Technology, and an advisory committee of which Dugald C. Jackson is the head.

The American Telephone & Telegraph Company about a year ago presented to the Institute the great Dering electrical library of more than 30,000 titles, the value of which is said to be about $100,000. With this gift the telephone company has assured to the Institute the sum of $5,000 a year for maintenance.

Another fund, by an anonymous donor, has been given to the Division of Electrical Engineering Research, this one of $5,000 a year for five years, for the purpose of determining the distance which a street car passenger can be carried for a five-cent fare, and return a reasonable profit to the transportation company. This investigation will discuss the various conditions of equipment and handling and is expected to prove of great value to electric-railway managements.

The research laboratory has also received a gift of $2,000 from the Boston & Maine and New York, New Haven & Hartford Railroad Companies for the investigation of freight-handling at terminals. This work will follow the lines which have been pursued at Technology for two years past, in investigating the relative efficiencies of various types of freight delivery trucks, including the electric vehicle. This work was undertaken on the initiative of President Edgar of the Edison Electric Illuminating Company of Boston, and was financed to the extent of $7,500 by that company. The results of the investigation have been embodied in bulletins on the behavior of motor trucks, which have attracted wide attention among manufacturers, transportation companies and vehicle dealers.

Two subjects of immediate research which Director Pender is to take up are related to the clearness of speech heard through the telephone—an investigation of the effects of phase relation of harmonics in sound waves; and a study of "skin effect," which causes a greater resistance of conductors when used for alternating than when used for direct currents. In this connection a 500-foot section of a 150,000-volt transmission line is a part of the new plant which the Institute is building in Cambridge. This is the highest voltage yet used commercially, and the section is completely equipped with wires, insulators, anchors, etc., being a section taken from a line now being installed by Stone & Webster on the Pacific Coast.

The laboratory will remain open in the summer and will engage a number of high-class trained experts.

LEGAL NOTES.

Michigan Telephone Tax Upheld.

The United States Supreme Court in a recent decision upheld the validity of the Michigan law of 1909 changing the basis of taxation of telephone companies from assessed value to earnings. This law had been attacked by the Citizens Telephone Company.

Telephone Rate Case.

The city of Louisville has petitioned the federal Supreme Court, at Washington, for a writ of mandamus to compel Federal Judge Walter Evans to distribute immediately among 7,500 Louisville subscribers of the Cumberland Telephone & Telegraph Company the sum of $137,365.15, representing the difference between the rates charged by the company from 1909 to 1912 and the rates fixed by a city ordinance. The ordinance rates have been sustained by the Supreme Court, but no distribution of the excessive charges has as yet been provided for. Judge Evans has ordered an investigation of the adequacy of the city rates, and the matter is now resting in his court in that status.

Kentucky Telegraph War Continues.

Suit for injunction has been filed in the Federal Court at Frankfort, Ky., by the Louisville & Nashville Railroad Company against the Western Union Telegraph Company, to prevent the removal by the latter of its wires from various parts of the line of the railroad company. The telegraph company was recently plaintiff in condemnation proceedings brought against the railroad, out of which this suit springs. It is alleged that the telegraph company proposes to remove its poles and wires, which would interfere with the operation of trains and work irreparable damage to the railroad.

Steam-Turbine Patent.

In the suit of the General Electric Company against the city of Dunkirk and the Board of Water Commissioners of that city for infringement of the Emmet patent No. 924,546 a decision has been rendered by the District Court of the United States for the Western District of New York upholding the validity of the patent. This patent covers the method of closing in the ends of the buckets in order to form passages of definite cross-sectional area and to reduce the losses by leakage. This is accomplished by means of tenons which pass through the openings in the covering at the ends of the vanes and are then riveted. The infringing turbine was built by the Allis-Chalmers Company.

Armstrong Patent Upheld.

The United States Circuit Court of Appeals for the Second District in an opinion handed down in the case of the Westinghouse Machine Company and Coloman De Kando versus General Electric Company and Albert H. Armstrong has sustained the validity of patent No. 811,758 issued to A. H. Armstrong, February 6, 1906. This patent covers the method for equalizing the load on two three-phase locomotives operating the same train. This is accomplished by using an independent set of resistances in the secondary of each motor which avoids the tendency of the motors to exchange current and throw most of the load on one of the motors.

It was claimed that De Kando was a prior inventor and that the device was used on the Valtellina Railway in Italy prior to the application for patent in this country. The decision is based upon the interpretation of the law that reduction to practice in a foreign country can never operate to destroy a patent applied for in the United States unless the invention be patented or described in a printed publication. Although the invention had been reduced to practice in a foreign country and a knowledge of it had been imported to individuals in this country, it did not meet with these requirements.

THE MORSE TELEGRAPH.[1]

By George C. Maynard, National Museum, Washington, D. C.

The year 1832,—eighty years ago,—marked a turning point in the world's advancing civilization and the beginning of a branch beneficent, revolutionary area. At that time the first practicable telegraph system was invented.

Means of ready communication between distant places had been one of the world's most urgent needs, from the time of its earliest habitation. Among primitive people many crude attempts to supply this need were tried.

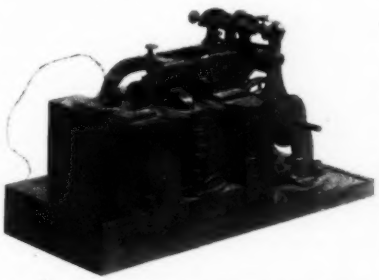
Records of the succeeding civilized ages are filled with speculations, mostly mythical and poetical, regarding possible means of communication, not only between widely separated points on the earth, but with the celestial planets.

The discovery and observations of electrical phenomena opened visions of wonderful possibilities of *its* use as a means of transmitting intelligence, and many plans were suggested and experimented with. None of them were permanently successful.

For centuries there rang through the world that prophetic cry of the inspired writer, a challenge to all people and to every passing generation, "Canst *thou* send forth lightnings, that they may go and say unto thee, Here we are?" To us it is fair cause for gratulation and patriotic pride that an American answered that challenge. Professor Morse, while on a voyage home from Europe, heard that call and responded "I can, and I will." From that hour his life was devoted to the fulfillment of his promise. Before the ship reached New York, November 15, 1832, he had sketched the outlines of the plan which he finally perfected. Most of the telegraph systems, previously proposed, required the use of a separate wire for each letter of the alphabet. Morse decided to use but one wire and, while on shipboard, invented the dot, dash and space alphabet which is now universally used. His successful work as an artist, which had brought him high and lasting honor, had fitted him, in large measure to become an inventor. The trained habit of creating thought, the faculty for investigating and solving new problems, of harmoniously combining different elements to produce a definite result, are requisite qualifications of both the artist and the inventor.

As an inventor Morse possessed none of the characteristics of the modern *"wizards."* He did not attempt to reach his goal by sudden, brilliant achievements. He pursued his investigations and experiments deliberately, systematically, intelligently, patiently and perseveringly, and with a faith in the success of the undertaking that never hesitated or faltered. In his early life he had studied the laws of electricity, magnetism and kindred subjects and he now resumed these studies with deeper interest. He familiarized himself with the experiments of others and profited by their successes and failures.

The history of the development of the electro-magnet, an essential part of a telegraph system, needs a brief



Morse Telegraph Register Used in 1844.

word of explanation. It was of slow growth, the result of the researches of many investigators. In the beginning of the nineteenth century it was known that a current of electricity, generated by a chemical battery, would flow through conducting wire and temporarily magnetize a bar of iron or deflect a magnetic needle. A little later it was discovered that this effect would be greatly increased by coiling the wire around the iron bar or the needle. In 1820, there appeared Schweigger's "multiplier" in which many turns of wire were coiled around a needle. In the same year, Sturgeon improved the electro-magnet by coating an iron bar, shaped like a horseshoe, with insulating varnish and winding upon it uninsulated wire in long spirals.

In 1827, Professor Ohm, of Munice, announced his discovery that a current of electricity in any circuit is equal to the intensity divided by the resistance. This rule, known as "Ohm's Law," affords data for the construction of electro-magnets for any desired purpose. About the same time Professor Henry, following the plan of the "multiplier" in making electro-magnets, experimentally proved that, with a current of high intensity, small long wires were necessary and that, with a current of low intensity, large, short wires were better. Morse did not know of Ohm's discovery but he had the benefit of Henry's explanation. Under these conditions he prosecuted his work on the invention. Lacking pecuniary means to procure materials or pay for the services of a mechanician, he took a common canvas stretcher from his studio, secured a secondhand, wooden clockwork to draw the paper through the register and with his own hands, constructed his first telegraph machine.

After much laborious effort, the apparatus was finished. During the years 1834-1836, it was frequently tested and exhibited to a few persons. On September 2, 1837, it was publicly exhibited in the College of the City of New York. The marvelous manner in which messages were sent over the line and correctly received, filled the witnesses with amazement and enthusiasm and gave assurance of the entire success of the invention. It was a complete, practical, operative telegraph system, capable of extension to any distance. The apparatus then exhibited, and the descriptions and explanations contained in unquestionably authentic documents, previously placed on record, conclusively show that the invention embraced the following essential features:—devices for the manual transmission of signals; for the automatic transmission of signals; for recording signals (by several practicable methods); the relay, (which was the forerunner of the repeater); and a sound-receiving instrument. The first instrument for embossing the Morse characters on a strip of paper by a steel stylus, of which record has been found, was made by Gilbert Smith, in the summer or fall of 1843, in his instrument-making shop, and in the presence of Morse and some other interested persons. Various processes for recording telegraphic signs had been tried with more or less success, when the embossing method was suggested. It proved the best of all and was at once adopted.

A memorial submitted to Congress by Morse resulted in the passage of a House resolution requesting the Secretary of the Treasury to report upon the propriety of establishing a system of telegraph for the United States. This request carefully avoided any reference to Morse's invention.

A circular letter, issued March 10, 1837, by Levi Woodbury, Secretary of the Treasury, was sent to a large number of Collectors of Customs, officers of the Revenue Marine and many scientific men in private life. Numerous replies were received all relating to semaphore telegraphs, and elaborate, detailed plans and estimates of the construction and operation of such lines were received. The Franklin Institute reported an exhaustive scientific investigation of the subjest and recommended the semaphores. It submit-

1 An address delivered on July 4, at Washington, D. C., at the dedication of a bronze memorial tablet on the site of the first commercial telegraph office in the world. (See ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, July 12, page 88.)

ted plans and estimates for building a line of 36 stations to connect Washington and New York, at a cost of $100,000 and an annual running expense of $62,500. Similar plans were submitted by prominent officers of the Navy and other Government Departments. In Morse's reply to Secretary Woodbury he explained his invention and asked an appropriation of $30,000 for building and testing a complete working line.

February 8, 1838, the telegraph was exhibited to the Franklin Institute, in Philadelphia, and was given unqualified endorsement by the officials of that institution including some of the men who, not long before, had ignored the electromagnetic telegraph and recommended the adoption of the semaphore system by the Government. Morse then brought his apparatus to Washington and obtained permission to exhibit it in the rooms of the House Committee on Commerce where it was examined by many congressmen and others.

On February 21, 1838, President Van Buren and his cabinet spent the afternoon thoroughly inspecting the apparatus and inquiring into all the details of its working. Every one who saw the telegraph was convinced of its practicability.

Another long, wearisome delay ensued and finally, on March 3, 1843, an Act was passed appropriating $30,000 "for testing the capacity and usefulness of the system of electromagnetic telegraphs invented by Samuel F. B. Morse, of New York, for the use of the Government of the United States, by constructing a line of said electromagnetic telegraphs under the superintendence of Prof. Samuel F. B. Morse, of such lengths, and between such points as would fully test its practicability and utility." The Bill provided that out of this appropriation a fair compensation for the services of Morse and persons employed under him should be paid.

The Secretary of the Treasury made the following appointments:

S. F. B. Morse, superintendent, $2,000 a year, Leonard D. Gale, assistant superintendent, $1,500 a year, J. C. Fisher, assistant superintendent, 1,500 a year, Alfred Vail, assistant superintendent, $1,000 a year, Ezra Cornell, assistant superintendent, $1,000 a year.

The preliminary work was promptly commenced. Morse had carefully considered the question of placing the line either underground or overhead, as might be found most expedient, and in all his preparations this alternative was kept in view. The underground plan was first tried.

A copper wire, insulated with cotton-twine wrapping at the ropewalk of Ebenezer Chase, at Bloomingdale, New York, and incased in lead tubing at Tatum's, Philadelphia, by a process patented by James E. Serrell, of New York, was laid along the east side of the Baltimore and Ohio Railroad track, from Baltimore to the Relay House, a distance of about ten miles. The wire was paid out from a reel carried on the frame of a plow that opened a furrow. Levi S. Bartlett contracted for the "trenching and covering" at $153 per mile. This work was done in December, 1843, under the immediate charge of Ezra Cornell. The insulation of the wire proved defective and the underground plan was abandoned before the end of the month. All the material was then shipped to Washington and taken to workrooms in the basement of the Patent Office Building temporarily assigned to the telegraph project. The wire was removed from the lead tubing, poles were purchased and set and the work of stringing the line wire was commenced April 1, 1844.

The Original Morse Telegraph Recording Instrument.

The telegraph exhibition room in the Capitol Building was continued during this period as the Treasury's Washington Telegraph Office, and one of the operators spent much time there anxiously watching the progress of the line building. The other operator was out on the road moving on with his instrument as the line progressed. On April 2 it had got beyond the "two-mile post." By the tenth, tests had been made four to seven miles out and all was going well. On the twelfth, ten miles of wire was up and working satisfactorily. The twentieth saw the line at White Oak Bottom sixteen miles distant. On the thirtieth, at Annapolis Junction, twenty-two miles, the wires working well. May 14, the office was opened at the Relay House and kept there until the 23d when the instruments were moved to Baltimore and set up in the "upper depot." On the following day, May 24, 1844, the first formal, official message, "What hath God wrought?" chosen by Miss Annie Ellsworth, was sent by Professor Morse from the Capitol office and received in Baltimore by Alfred Vail.

One of the receiving instruments used when this message was transmitted has been preserved and is in Cornell University. Contradictory statements regarding the manufacture of this apparatus have been made. On April 1, 1843, the Government paid $150 *"for two telegraph registers,"* to Philip Schuyler. These were evidently the instruments in question.

Morse's original recording instrument, now in the United States National Museum, is still in working order.

The experiments on the line during this construction period were not confined to electrical tests to show the condition of the line. The operators constituted themselves as a voluntary information bureau and sent back and forth any items of news that promised to be of public interest. The representatives of the press were quick to take advantage of this opportunity and often offered reports on subjects of especial importance. The railroad frequently used the telegraph to aid in the dispatching of trains. In some instances bank checks were informally certified; daily reports of weather conditions were sent. On June 10 1844, Captain Charles Wilkes, of the United States Navy, with an assistant, made the first use of the telegraph in comparisons of time between Washington and Baltimore, taking their chronometers to the telegraph office for that purpose. Captain Wilkes reported "after these experiments I am well satisfied that your telegraph offers a means for determining the distances more accurately than was before within the power of instruments and observers."

The office remained in the United States Capitol Building until September 25, 1844, when it was moved to a building on Seventh Street then standing on the site marked by the tablet now unveiled.

That building was an ordinary two-story dwelling house, with an outside stairway leading to the second story, on which the telegraph office was located. The front room, facing Seventh Street, was occupied as an operating room, the other rooms by the main batteries and other accessories.

The Sundry Civil bill approved March 3, 1845, contained an item appropriating $8,000 "for defraying the expenses of the magnetic telegraph from the city of Washington to Baltimore for the current year, ending on the first day of February next" and placed the line under the control of

the Postmaster General. That official appointed Professor Morse superintendent at a salary of $2,000 per year, Alfred Vail, assistant superintendent at $1,400, and Henry J. Rogers, assistant superintendent at $1,000, fixed the tariff on messages at "one quarter of one cent for each telegraphic character," and ordered the Baltimore office moved from the depot to the Post Office. The three persons named as superintendents were the practical, working operators and it was some months before any other operators were added to the force. Vail generally worked in Washington while Rogers was in the Baltimore office, although they frequently exchanged places and Morse rendered service anywhere and at any time he was needed. While the receipt of messages by sound was prohibited, Morse and Vail, at least, were in the habit of reading the sound signals made by the instruments. The business passing over the line, being limited to the two cities of Washington and Baltimore, brought in a very small revenue, not enough to pay the costs of operating.

At the end of the period fixed by law, February 14, 1846, the Government and the telegraph came to the parting of the ways, and separated with feeling of mutual disappointment and regret. Morse hoped, from the first, to finally transfer his invention to the Government, accept a reasonable compensation for his labors and be relieved from the severe strain and burden of organizing and carrying on the business as a commercial enterprise.

The Postmaster-General, and many other prominent officials, held to the opinion "that an instrument so powerful for good or evil could not, with safety to the citizens, be permitted to remain in the hands of individuals."

Morse immediately organized a commercial company and started the business. The outcome proves that the intelligence, the enterprise and the integrity of the American citizen can be relied upon to carry forward an epoch-making, world-revolutionizing undertaking, to complete success, with due regard to the best interests of the public with unfailing loyalty to the Government.

From 1832 to 1913 is a short period of time. Measured by its achievements, it runs into ages! At its beginning that frail strand of wire connected two cities in a bond never to be broken. When the skillful hand of its inventor sent out that historic message, chosen by the noble impulse of a gentle woman, the wire sounded a reverent note of recognition of the guiding power of the Great Creator, to whom the secrets of the Universe are known and Who reveals them to earnest seekers after truth. Now millions of miles of wire form a marvelous system that encircles the world and encompasses humanity and brings all the people near together in understanding and unity. They are still sounding an inspiring note,—of praise to the man who gave them voice,—of honor to the Nation whose wisdom and liberality afforded opportunity and encouragement to the best efforts of inventors and leaders. Today, while the flags of the nation are flying everywhere, they sound a note thrilling the hearts of all citizens with renewed resolve that the glorious banner shall continue to hold its rightful place, at the head of the line, in the World's forward march, while always, in solemn, reverent undertone, rings the spirit of that first message, "What hath God wrought." This memorial dedicated today shall stand for years to tell the story of that eventful period, —the influences of these great events shall last forever.

Lotschberg Tunnel Railway Opens With 2,500-Horsepower Single-Phase Locomotives.

The new Lotschberg Tunnel through the Alps in Switzerland was opened for traffic on June 28. This tunnel is the third longest in Europe, being over 9.25 miles in length. The cost of the tunnel alone was nearly $10,000,000 and the entire railway of which it forms a part, over $17,000,000. This railway affords a more direct service between western France and northern Italy. Three express trains are now run daily from Nancy, France, through Berne, Switzerland, to Milan, Italy, the running time being reduced to 11 hours. The new line extends from Spiez, through Frutigen and Kandersteg (where the tunnel begins) and through Brig, where it connects with the Simplon Tunnel leading to the Italian frontier. Electric traction is used on the entire route from Spiez to Domodossola, Italy.

The working current is supplied at 15,000 volts, single-phase, 15 cycles, through an overhead conductor with catenary suspension. The portion of the road from Spiez to Frutigen was equipped with this system in 1910, electric locomotives of 2,000 horsepower comprising two-1,000 horsepower single-phase series motors being used. For the increased service demanded by the opening of the new tunnel 13 additional locomotives of similar construction but each rated at 2,500 horsepower have been furnished by the Maschinenfabrik Oerlikon, of Oerlikon, near Zurich.

Each of the new locomotives is equipped with two motors each rated at 1,250 horsepower in steady operation for 1.5 hours at a speed of 31 miles per hour. They are capable of developing a draw-bar pull of 22,000 pounds while pulling a 340-ton train on a grade of 2.7 per cent at the 31-mile speed. The maximum speed for which these machines were designed is 46.5 miles per hour. In starting and for short periods the locomotives are capable of developing 30 per cent greater tractive effort than in normal operation. Each locomotive has five driving axles and a guide axle at each end. The five drive wheels on each side are connected by a side rod. The two motors are mounted near the center of the cab with their shafts somewhat above the driving wheels. Each motor drives a crank shaft through a single-reduction double-helical spur gear with a ratio of 1 to 2.23. The two cranks are connected together and to the side rods which join the drive wheels through a triangular connecting frame work.

The electrical equipment of each locomotive is entirely in duplicate. For this purpose a set of interconnections is provided that permits connecting the two transformers in parallel or operating them singly, likewise the motors can be operated singly, both independently or both in series. Two pantograph bow collectors are mounted on top of the cab. These connect through protective devices to two high-tension oil switches that lead to the primaries of the transformers. The transformers are air cooled through a special ventilating set. The secondary is provided with 12 taps, each having a potential difference of about 45 volts. The control equipment consists of a motor-driven controller by means of which the voltage applied to each motor is changed by connecting to successive taps on the transformer. No resistances are used and therefore the efficiency at all loads at normal speed is claimed to be about 95 per cent.

The motors are of the compensated commutator type. They are provided with 16 poles and are of open construction, so that the air has free access to all parts. The maximum current taken by each motor is about 3,000 amperes; the maximum voltage they receive is 430 volts. The motors are mounted in a separate compartment of the cab which is provided with a special ventilator. A rotary converter set is provided in the locomotive which furnishes direct current for charging four lighting batteries and also current for the operation of various auxiliary motors on the locomotive. The high-voltage compartments in the locomotive are isolated by means of special doors equipped with locks that are interconnected with the high-voltage supply in such a way that entrance to the compartments cannot be had until the high voltage is cut off.

HIGH-VOLTAGE TESTING AND TESTING APPARATUS.

By F. C. Loring.

High-tension transmission as a branch of electrical engineering has been unsurpassed in the last decade in rapidity of development. It has been so rapid that engineers have not had sufficient time for the proper study of certain phases of the problem. In consequence no subjects are receiving more attention that the properties of high-tension insulators, especially the suspension or link type, and of insulating high-tension transmission lines. Insulator design and testing is of the utmost importance financially to transmission companies, as the breakdown of a single insulator may result in the destruction of other and much more costly apparatus.

One system, that of the Eastern Michigan Power Company, is in operation at 140,000 volts and another system has under advisement the adoption of 180,000 volts.

In order to be able to carry on experiments in this most important work the Electrical Department of the University of Illinois has recently received and installed a 200,000-volt testing equipment consisting of a high-voltage transformer with controlling and measuring apparatus. This equipment will be used for the study of high-voltage problems. Some of these are corona phenomena, the action of lightning arresters and other protective apparatus and the determination of the breakdown point of oil and of various forms of insulators.

The transformer is of the type designed for the connection of the ammeter and wattmeter at the grounded neutral point of the high-tension winding, which gives the losses directly with high accuracy. It is shown in Fig. 1, and is rated at 100 kilowatts at 60 cycles. The low-tension voltage is 500, 1000 or 2000 volts according to the connections of the windings. There are altogether 160 turns.

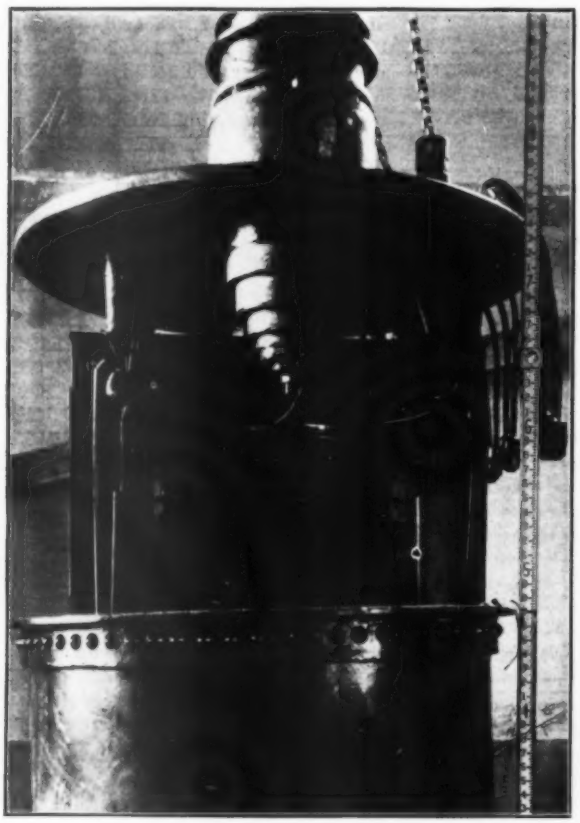


Fig. 1.—High-Voltage Transformer.

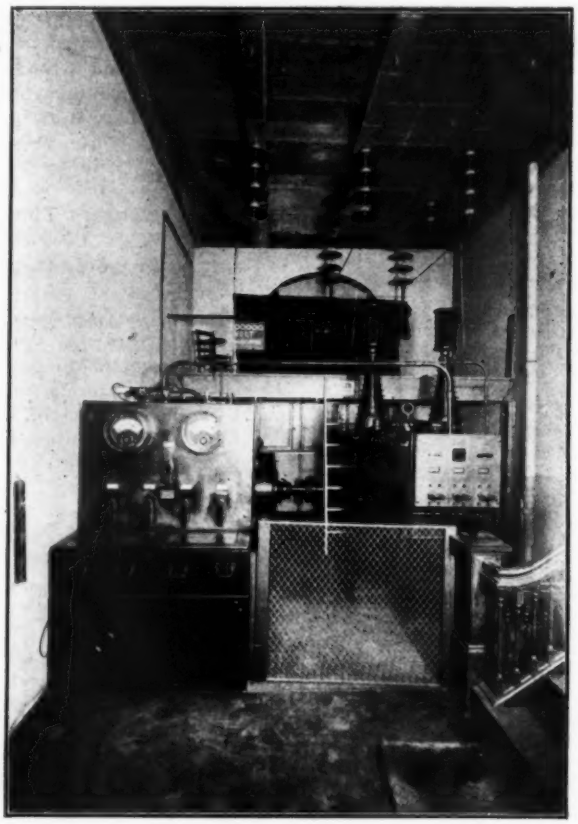


Fig. 2.—High-Voltage Testing Outfit.

The high-tension winding consists of eight large coils with 1019 turns each, and 12 small coils of 640 turns each. There are four buffer coils, two at each end, of 38 and 46 turns respectively.

The core and windings are immersed in a special oil which has a high flashing point and good insulating qualities.

The controlling apparatus consists mainly of two switchboard panels, as shown in Fig. 2. The smaller of the two is mounted on pipe supports near the transformer, to which are attached the various low-tension leads and high-tension voltmeter leads.

For making tests a special switchboard is used consisting principally of two slate panels and two drawers with glass tops for the instruments, these being mounted on framework of angle iron and inclosed within a heavy iron-wire network.

The panel sections on the front are composed of ebony asbestos lumber. This arrangement while seemingly expensive was considered necessary to eliminate all danger, as it is not possible for an operator to come in contact with any live parts unless through carlessness.

The measuring apparatus consists of four single-phase wattmeters, two ammeters, three voltmeters, frequency meter, power-factor meter, two potential transformers and a spark gap.

The middle point of the high-tension winding is permanently grounded on the core. Fastened to the top of the high-tension terminal leads are reactance coils. Wires are carried from the tops of these coils and fitted into small long glass rods filled with a conducting liquid. From the upper ends of these glass rods, which are mounted vertically, attachment is made to copper rods which carry the high-voltage current to the article under test. These copper rods are fastened to the lower ends of a string of four (50,000 volts each) insulators in series.

The ceiling of the high-tension room was covered with one-half-inch wire gauze. This ceiling together with all

conduit, machines and switchboard panels was thoroughly grounded to a water pipe.

The complete arrangement of connections and apparatus for measurements are as shown in Fig. 3.

Standardizing Testing Methods.

The standardizing of methods of testing is very urgently needed. This applies to all classes of insulating materials. In addition to the need for standard methods of insulator testing attention must be given to the definition of terms used in connection with standardizing for physical tests on the parts used in towers, for galvanizing tests and for electrical and physical tests on the conductor materials, but as to standardizing methods for testing insulators, nothing definite has been done, although they are the most important element in the transmission line.

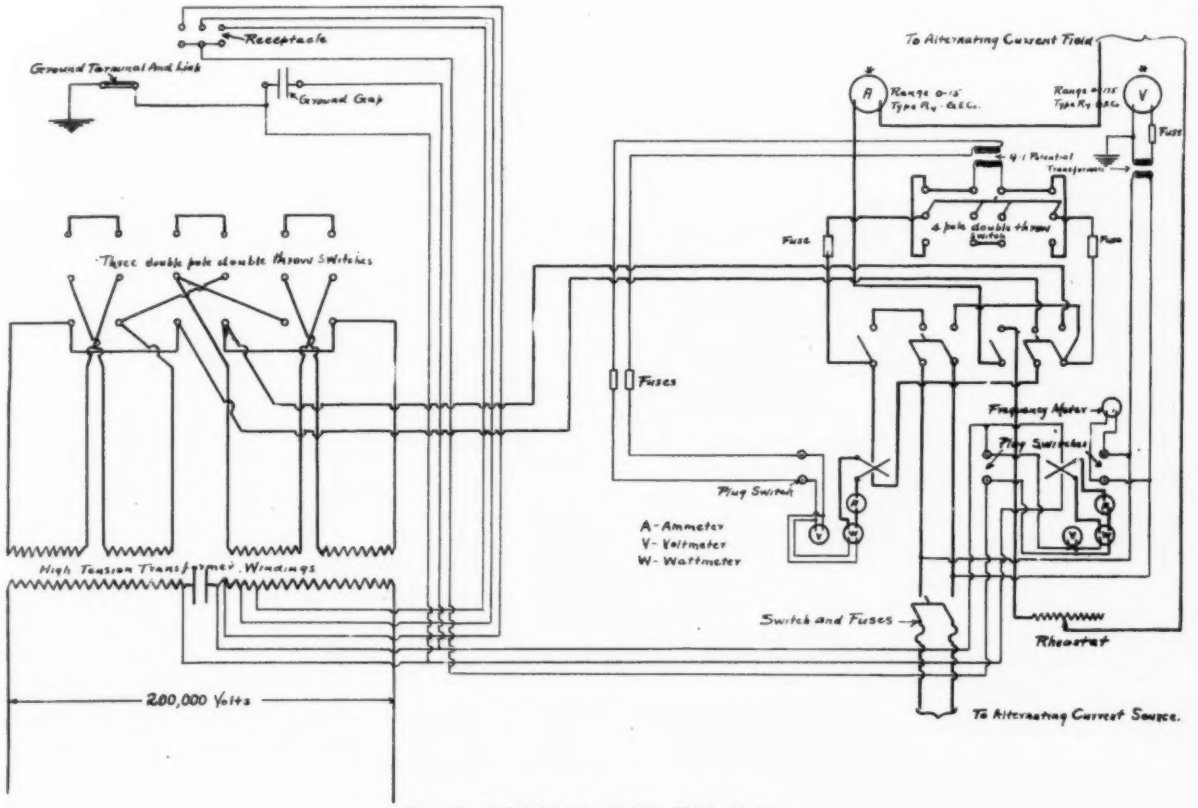


Fig. 3.—Switchboard Wiring—Back View.

Insulators.

The following conditions represent the consensus of opinion as regards insulator testing at this time:

(1) *Method of Support.*—The insulator should be supported as nearly as possible as in service. The top of the insulator should be grounded in suspension insulators and the pin in pin-type insulators. Support the insulator with approximately the same-size apparatus as the service cross-arm. The conductor to which the voltage is applied should be of the same size as the line conductor and of sufficient length to prevent concentration of stress on the ends from affecting the test. The insulator should not approach closely any large bodies.

(2) *Capacity of Testing Transformers and Generators.*—These should give sufficient power to allow a true dynamic arc to start before an appreciable change can take place in the wave form, also to prevent the regulation of the testing system being changed by the insulator load.

(3) *Generators.*—Generator wave should be free from high harmonics and reasonably close to a sine wave.

(4) *Transformers.*—These should be properly designed and have a ratio that remains practically constant. The iron should not be too highly saturated. Voltmeter coils are the best for careful measurements. One terminal of the transformer should always be grounded.

(5) *Method of Regulating the Voltage.*—Use one which avoids distortion of the wave shape. Control of potential by generator field within small limits (never below half field) in combination with the potentiometer method is best.

(6) *Determination of Voltage.*—(*a*) Use a spark gap, which shows the maximum of the voltage wave. (*b*) The needle gap gives fairly reliable results if correction is made for all of the variables, as temperature, humidity, etc. (*c*) The sphere gap is satisfactory when the spheres are large enough so that sparkover takes place before corona can form. Correction must be made for temperature and barometric pressure. (*d*) Place water-tube resistances in series with the gap so as to limit the current to one-half ampere. (*e*) Check the ratio of the transformer against the spark gap when connected to the insulators and use this ratio as a final means of finding the exact voltage.

(7) *Flash-over Test.*—In determining flash-over tests, insulator must not be allowed to become heated by the arc.

(8) *High-Frequency Test.*—No acceptable test has been developed. Research should, however, interest itself in determining the following: (*a*) The effect of frequency itself on a standard type of test insulator, by changing the constants of the high-frequency discharge circuit. (*b*) The effect of high frequency on strings of suspension insulators. (*c*) The effect of the distribution and size of petticoats and the control of the potentials of various parts of the surface of insulators. (*d*) The adequacy of the high-frequency test to determine the effect on the behavior of any insulator of variations of test frequency, of the amount of the excess series-gap voltage over and above the flash-over voltage of the insulator, of the amount of static capacity connected with the high-frequency discharge circuit, of the length and character of the discharge path and the effect of the

method of securing the actual conductor and the tie wire during the test.

(9) *Wet Test.*—This includes two conditions of artificial rain, one for large drops with a precipitation of not less than 0.3 inch or not more than 0.5 inch per minute and the other for a mist with a precipitation from 0.25 to 0.3 inch per minute. The rate of precipitation is to be obtained by the use of suitable rain gauge. Use a specific rain resistance corresponding to the water used, whatever its locality. The rain should be at an angle of 45 degrees to the horizontal for vertical insulators and 45 degrees to the inside of horizontal or strain insulators. The minimum period of precipitation before voltage is applied should be specified; also specify the time of application of full voltage. The current, due to leakage, should not be excessive under these conditions.

(10) *Corona Test.*—The insulator should not show a corona loss at normal operating voltage.

(11) *Design Test.*—This consists in applying a little over twice the line voltage under wet conditions at a barometric pressure equal to the mean pressure at the maximum altitude for which the insulator is to be used; voltage to be applied between conductor clamp and lower support.

(12) *Parallel Test.*—Connect all insulators in parallel and subject to the test voltage simultaneously.

(13) *Puncture Test.*—Immerse the insulator in oil, noting the time element as the voltage is raised. Two ways of handling the time and voltage elements have been suggested: (*a*) Gradual and steady increase of the voltage until puncture occurs. (*b*) Increase of voltage by stated amounts at stated intervals, noting when puncture occurs.

(14) *Mechanical Test.*—This consists in mechanically loading the insulator and using a dynamometer or other suitable device for indicating the breaking strength in pounds.

(15) *Miscellaneous Observations.*—Record the frequency, temperature, barometric reading and humidity.

Protective Apparatus.

There is no fixed practice in testing lightning arresters corresponding to the well known and satisfactory tests of other pieces of apparatus used in electrical transmission.

The following tests are suggested:

I. Direct-current static potential test.

II. Alternating potential from an alternator; time of application variable, usually long. (*a*) At alternating frequency. (*b*) Metallic ground; harmonics to about the twenty-first. (*c*) Arcing ground; high-frequency (300,000 cycles).

III. Disruptive-stroke test. (*a*) Simple disruptive stroke-test circuit, direct-current or alternating-current discharge. (*b*) Dielectric spark lag. (*c*) Proper frequency, four million or less. (*d*) Time of application of potential short. (*e*) Frequency of applications of potential variable.

IV. Thompson transformer or inductorium test. (*a*) 100,000 cycles. (*b*) Continuous application or variable.

V. Half-wave test. (*a*) Electromagnetic recoil-variable unidirectional potential. (*b*) Time of application short.

VI. Arc-extinguishing quality test.—Rectifying limit set by splashing of molten metal.

VII. The equivalent spark-gap characteristic-curve by the disruptive-discharge test.

VIII. The equivalent spark-gap or generator frequency.

IX. The maximum discharge current at normal voltage and at double normal voltage.

X. The half-wave equivalent spark gap.

XI. The endurance of the device.

The features of lightning-arrester apparatus, for electric lighting and power circuits, most susceptible of satisfactory tests are: (1) the initial breakdown voltage; (2) the static equivalent during discharge; (3) the circuit-opening power; (4) the insulation strength; (5) the ability to stand repeated discharges; (6) the choking power and insulation strength of choke coils and equivalent apparatus.

High-Tension Transmission Line Tests.

An outline of the tests that are ordinarily conducted on high-tension lines include:

I. Investigations in laboratories on artificial lines and where the testing apparatus is of comparatively small size.

II. Investigations on (*a*) experimental lines or (*b*) on high-tension lines under operating conditions. Tests (I) constitute those showing the various transient and other phenomena on single and three-phase lines in connection with switching, sudden changes in load, etc. Set (1) includes recording the voltage at the generator end, the voltage at the receiver end, and the line current upon: (*a*) closing the line near the zero value of the voltage wave; (*b*) closing the line near the maximum point of the voltage wave; (*c*) opening the line while loaded; (*d*) switching an open line on to a live line.

Set (2) includes the measurements of current and voltage on single and three-phase lines with the far end open and closed, unloaded and loaded non-inductively and inductively for different commercial frequencies.

Tests II (*b*) include determinations for the following on single and three-phase lines, loaded and unloaded: (1) Total kilowatt losses. (2) Variation of corona loss with (*a*) voltage; (*b*) diameter of conductor; (*c*) distance between wires; (*d*) frequency, including higher harmonics of the generator wave; (*e*) atmospheric conditions. (3) Resistance loss. (4) Insulator loss. (5) Transformer loss. (6) Wave distortion. (7) Charging current. (8) Spark tests.

The Illumination of Factories and Workshops.

The British Government's annual report[1] on this subject, just issued, contains much interesting information respecting illumination practice. It is admitted that in the past the lighting of factories has been too often neglected, but it is now rapidly becoming a more prominent question. The problem offers many technical difficulties, and it is hoped that the recently appointed Departmental Committee may be able to make recommendations, based on scientific principles, which will benefit both employers and employees. The design of the modern factory is, in itself, proof that employers recognize the economic value of good lighting, but there seems to be lack of knowledge of the general principles on which efficient lighting should be carried out.

A special inquiry dealing with this subject was undertaken by R. D. Wilson in foundries in different parts of the country, and he has prepared a special report. Forty iron foundries in different parts of England were visited in order to ascertain the efficiency of the artificial illumination. He says that so far as the actual carrying on of the work is concerned, the intensity of the illumination appears to be of little importance. At the moment of pouring, ample light is derived from the molten metal itself, and the previous and subsequent processes can be, and often are, carried out with the aid of supplementary light obtained from portable lamps. Insufficient light is undesirable from the point of view of accidents, caused by stumbling during the passage from one part of the foundry to another, especially when handling metal or when passing near molding pits or parts of the foundry in which metal has been recently poured. In other words, general rather than local illumination seems to be the important matter to be considered. Mr. Wilson quotes the following as the general lighting characteristics possessed by a foundry, but absent or less pronounced in other works:

(1) The whole of the floor space is covered with very dull and dark material. Measurements of the diffused reflecting power of this surface indicate that only about 2 to 3 per cent of the incident light is reflected.

(2) The material covering the floor is of uniform color, and there is almost complete lack of contrast throughout the room. There is, there-

1Annual Report of the Chief Inspector of Factories and Workshops, 1912.

fore, no surface to serve as a contrasting background for obstacles, which are often difficult to distinguish.

(3) The processes involve the production of much dust, and at certain stages of the work dense smoke is evolved.

(4) Shadows said to be specially undesirable, probably on account of the further reduction of the illumination.

(5) Glare is liable to result from the molten metal (and sometimes from badly shaded light sources placed too low) with the consequence that the eye is temporarily dazzled, and risk of stumbling is increased.

From the foregoing remarks it will be seen that for efficient lighting the illumination in iron foundries should be high compared with other rooms. Objects of similar and very low diffused reflecting power are the more readily distinguishable the more intense the illumination received by them, since contrast is enhanced by the increased difference in the amounts of light reflected. More efficient contrast could also be obtained, especially in small foundries by frequent limewashing of the walls, the white surface of which would then serve as a background for the dark-colored objects on the floor. In addition to this advantage, a white wall does much to increase the actual illumination, especially with natural lighting. The walls in many foundries are already limewashed, but they are often almost black owing to the deposit of dust.

The presence of smoke in any quantity greatly reduces the illumination on the floor, especially when the light sources are situated high up. This is, generally speaking, only a temporary matter, since the smoke soon makes its escape from the room, but it constitutes one more argument in favor of as intense an illumination as possible.

Dust, according to the report, has a more permanent deleterious effect in foundries where incandescent gas is the illuminant, since it is said to injure the mantles and to block the air orifices.

Shadow is specially undesirable, as tending to confuse the eye and as reducing the illumination. In considering shadow, three points are of importance, namely, position, extent, and depth. The position of a shadow is determined by the position of the responsible light source. The latter should, of course, be placed in the locality in which the shadow is undesirable. The extent of the shadow depends on the height of the light source; the greater the height, the shorter the shadow. The depth depends upon the presence or absence of neighboring light sources, or, in other words, on the evenness or unevenness of the illumination. For this reason, for the lighting of a given area, it is preferable to have two sources of, say 1,000 candlepower each, rather than a single source of 2,000 candlepower.

It would appear that the most satisfactory method of lighting is by means of powerful units, fixed as high as possible above the floor and spaced comparatively close together.

The results of observation show that a sharp distinction may be drawn between well and badly lighted foundries. In some of the former the very high minimum value of 1.5 foot-candles is attained and even exceeded, and the lighting may be considered good if the illumination does not fall below 0.5 foot-candle.

In the badly lighted foundries it was noticed that in almost all instances the system of lighting consists of ordinary flat-flame gas burners. In addition to their feeble intensity, these have other disadvantages. They are of necessity placed low down and in contrast with their dark surroundings tend to dazzle the eye; they are also liable to flicker unpleasantly and to cause confusing shadows, and are uneconomical from the point of view of gas consumption. Only one foundry lighted in this way could be described as even moderately well lighted; the others vary from the poor to very bad. The actual data indicate the extremely bad lighting that exists in some of these foundries, measurements as low as one sixtieth of a foot-candle being recorded. Some idea of this deficiency may be given when it is remembered that the minimum illumination in a poorly lighted suburban street is about one-hundredth of a foot-candle. It is probably impossible to secure really efficient lighting with the old-fashioned gas jets, and these should be replaced by some modern high intensity system under expert advice, whereby not only would the illumination be greatly increased but a large saving in the amount of gas consumed would follow.

The investigation appears to show that the illumination received on a horizontal plane one foot above the floor level in: well lighted foundries does not fall below 0.5 foot-candle; in fairly lighted foundries does not fall below 0.3 to 0.4 foot-candle; in moderately lighted foundries does not fall below 0.2 to 0.3 foot-candle; in poorly lighted foundries does not fall below 0.1 to 0.2 foot-candle; and in badly lighted foundries is below 0.1 foot-candle.

It would seem therefore that the lighting cannot be deemed to be adequate unless the illumination received on a horizontal plane one foot above the floor level is not less than one third of a foot-candle over any part in which work is being carried on or over which any person is liable to trespass.

The subject of factory illumination has also been receiving the attention of other inspectors, one of whom has been urging the use of frosted globes and the better placing of electric lamps in printing works, with the object of reducing glare. Other officials report upon the satisfactory results attending the use of mercury-vapor lamps in different factories, one of them remarking that this light is said to be softer to the eyes, and that in consequence complaints of headaches are less frequent amongst the workers.

North Dakota Has Great Fuel Resource.

The production of coal (lignite) in North Dakota in 1912 amounted to 499,480 short tons, valued at $765,105, compared with 502,628 short tons in 1911.

On account of its heavy percentage of moisture and rapid disintegration on exposure, lignite does not stand transportation well, and consequently its field of usefulness has been thus far limited. Its principal use has been to supply fuel to the settlers on the treeless plains in the western part of the state, and for that purpose it has been mined in a crude way in almost every county in the lignite-bearing area. Commercial mines are situated on the lines of railway and supply the towns of the state with fuel for domestic purposes and for use under steam boilers.

But lignite has been found to be an excellent fuel for the generation of producer gas, and with the development of manufacturing industries in the state, the extensive deposits of lignite in North Dakota will receive more attention as a source of power. It has been found that one ton of lignite in the gas producer will yield as much horsepower in internal-combustion engines as one ton of the best bituminous coal under boilers. As the gas producer and internal-combustion engines in large units come into more general use in the West, as they are rapidly doing in the East, the hundreds of billions of tons of lignite known to underlie North Dakota will be found to possess great potentialities in the settlement and economic development of the state.

Copper Exports.

Exports of copper for the week ended July 10 totalled 7,301 tons, a decrease of 3,016 tons. Since January 1 205,566 tons have been exported, an increase of 18,251 tons.

West Virginia Coal Production for 1912.

The production of coal in West Virginia in 1912 reached the total of 66,786,687 short tons, valued at the mines at $62,792,234.

West Virginia is one vast coal field, all of the state west of the escarpment of the Allegheny Mountains being in the coal-bearing formation, and the actual coal area embracing about 17,000 square miles.

The coals of West Virginia are all bituminous or semi-bituminous and are mostly of high grade. The average price per ton was 94 cents in 1912, against 90 cents in 1911.

For the last four years, including 1912, West Virginia has held second place among the states in the quality of coal produced, having taken the lead over Illinois in 1909. When the value of the product is considered, however, West Virginia drops to a rather poor third. On a comparison of thermal efficiency the average of West Virginia's coal is higher than that of Illinois by 25 to 30 per cent. The average price of Illinois coal, on the other hand, is from 20 to 25 per cent higher than that of West Virginia.

Subway Proposed for Genoa, Italy.

Preliminary approval has been granted to a project for the building of a 6.3-mile traction subway from Sampierdarena to Genoa, and thence to Quarto dei Mille along the coast. Estimates of cost of the work and materials have not been definitely adopted, but the original estimate contemplated expending at least $3,667,000, which will no doubt be increased. The subway would have 14 stations. There would be almost 28,900 feet of underground tunnel, mostly rounded, inside, about 3,250 feet elevated in the open, 1,214 feet on ground level, and 270 feet of bridge work. Direct-current, third-rail electric traction would be used. Passenger trains of most modern type would be employed, the maximum length of each car to be 49.21 feet, capacity 80 passengers each. The trains would be provided with 4 motors of 55 horsepower each.

Electrical Machinist Wanted.

The United States Civil Service Commission has announced an open competitive examination for electrical machinist to fill a vacancy in the signal service at Fort Wood, N. Y., at a salary of $1,000 per annum. The examination will not be written, but ratings will be based upon statements as to training, experience, general fitness and physical condition. Applicants should be practical machinists with experience of three years or more in the repair of telephone and telegraph instruments and switchboards, radio apparatus, etc. Application Form 1,312 should be obtained from the Civil Service Commission, Washington, D. C.

Quick Recovery from Shreveport Power Plant Fire.

Supplying the business section of a city of 35,000 population with power for motors and all lighting requirements within six or seven hours after his plant had been practically totally destroyed by fire was the almost superhuman accomplishment of J. E. Cowles, superintendent of the electrical department of the Southwestern Gas & Electric Company's Shreveport, La., plant not so very long ago; and that after the same plant had been partially disabled by another accident a few days before.

During the early afternoon of February 26 last, the plant was disabled by the collapse of the structural-steel framework of a 160-foot tile roof covering an extension of the engine room then in course of construction; 59 men were buried beneath tons of twisted trusses and crumbled brick and tile of the roof and walls, but with the exception of one negro all escaped with only minor injuries.

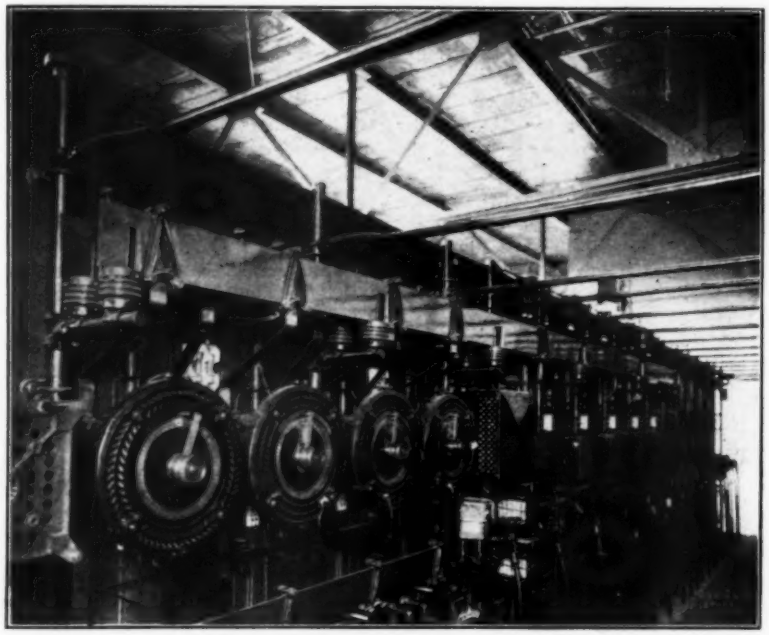
In falling, one of the roof members tore away a portion of the old engine-room wall, left standing to shelter the switchboard while the extension was being built, and left the board exposed, but by the morning of the next day a temporary wooden inclosure had been built around its weather sides and the plant again placed in operation.

The reconstruction of the addition, designed to house the largest gas-engine set in the Southwest, was at once begun and was about completed on March 13 when the plant was again visited by disaster, this time by a fire resulting from a short-circuit on the high-tension three-phase power circuit.

The short occurred shortly before 7 p. m. of a soggy, dismal day, the flash at the board igniting the temporary wooden shelter from which the fire quickly spread throughout the engine room, in one corner of which the board was located, putting out of commission all but one of the plant's four generating sets. Three 48-inch belts driving as many generators, two 40-kilowatt exciters and one 400-kilowatt generator were destroyed inside of ten minutes, the fire lasting not more than a quarter of an hour.

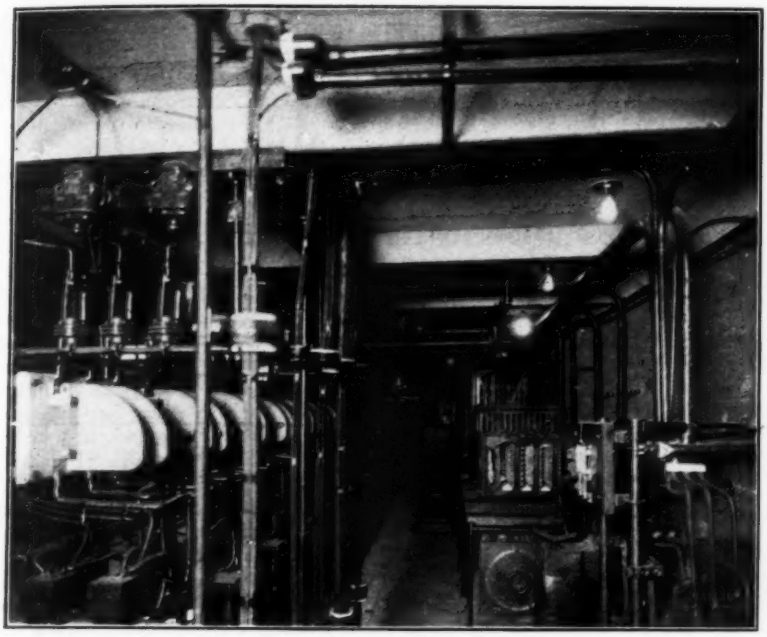
The engine room had not cleared of smoke when Mr. Cowles got busy. Hunting up all the scrap belting he could lay his hands on he managed to splice one of the belts which fortunately was only half burned and by three o'clock on the following morning, eight hours after the fire, he had two three-phase power circuits working and by ten o'clock all the lighting circuits were in service, the demand being met by the one belt-driven generator and a 750-kilowatt direct-connected Allis-Chalmers generator, the only piece of machinery not affected by the accident.

The only instrument the plant had left was a 300-ampere type K General Electric oil switch and through this and a set of buses installed on two poles set up in the alley adjoining the plant the entire city was served. In the meantime a contract had been placed with the Southwestern General Electric Company, of Dallas, Tex., for a new switchboard and new belts were ordered from Chicago. On an emergency order the belts



125-Volt Control Board.

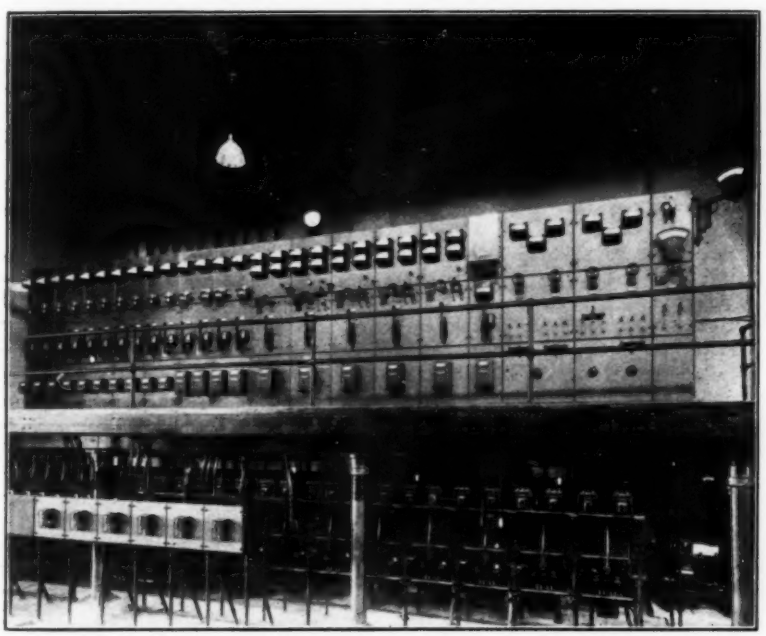
were shipped, received and fitted and the three generators placed in service on the following Wednesday, the fire having occurred on Thursday.



2,200-Volt Control Equipment.

The specifications and drawings of the new switchboard were prepared by Mr. Cowles himself and included five 1,000-kilowatt generator panels, four three-phase circuit panels, nine single-phase circuit panels, and four exciter panels. The board is of the remote-control hand-operated type and contains the very latest instruments and protective devices, each panel being equipped with indicating and recording wattmeters, alternating-current voltmeter and ammeter, time-limit relay circuit switch and non-automatic generator oil switches.

The Southwestern General Electric Company guaranteed in its contract to ship the board within two weeks of the receipt at the factory of complete specifications and drawings and completed the record-breaking feat of delivering it (F. O. B. Schenectady) on April 12, 21 days from the date of the order. Through the unceasing activities of C. W. Hobson, general manager of the company, it was received in Shreveport on April 19. O. A. Jennings, the genial sales agent of the company, who had received the order, devoted special time and attention to making this installation one of the best in the Southwest.



Main Switchboard.

No time was lost in setting up the board at the plant and within three months of the date its plant had been completely wrecked the Southwestern Gas & Electric Company was giving its patrons regular and satisfactory service.

Prussian Government Hydroelectric Project Approved.

De Witt C. Poole, Jr., United States vice-consul-general at Berlin, Germany, has sent an interesting report on the Prussian Government hydroelectric project. The Prussian Parliament has recently enacted a law appropriating $2,500,000 for developing power on the upper reaches of the River Weser in Hanover Province and Waldeck Principality. It is proposed to utilize the water heads afforded by the already existing reservoirs at Hemfurt on the River Eder and Helminghausen on the Diemel, both source streams of the Weser, and later to connect these power plants with a third to be built at Munden, where the conflux of the Rivers Fulda and Werra gives rise to the Weser proper. In keeping with the more recent Prussian policy of direct development of water powers by the State, the waterways department of the Prussian Ministry of Public Works will undertake not only the construction but also the subsequent sale, up to a certain point, of the power to be developed.

The reservoirs at Hemfurt and Helminghausen were built by the Prussian Government in connection with the construction of the Rhine-Hanover Canal under the law of April 1, 1905. When full the reservoir at Hemfurt imprisons 1,975 million gallons of water and the water head at the dam is then 135 feet. The reservoir at Helminghausen holds 194 million gallons of water when full. The maximum head is 114 feet.

The hydroelectric station to be erected at Hemfurt, according to the present plan, will be equipped with six turbines each developing 2,500 horsepower at a 105-foot head, six 2,300-kilowatt generators and three 5,000-kilowatt, 6,000/40,000-volt transformers The cost, including machinery, buildings, and all accessories is estimated at $452,500. The station at Helminghausen will be equipped with two turbines, each developing 600 horsepower and one developing 1,200 horsepower at 90-foot head, two 600-kilowatt generators and one 2,000-kilo-

watt, 6,000/40,000-volt transformer. The cost of this station is estimated at $95,200. The third station—to be built later on the Weser at Munden—will cost with its various accessories $892,500. The machinery installation will include six turbines, three developing 1,240 horsepower each at a water head of 12.7 feet and three developing 460 horsepower at a head of 6.9 feet; three 1,200-kilowatt generators; and two 4,000-kilowatt, 6,000/40,000-volt transformers. In addition, a canal will be made at an estimated cost of $183,736, exclusive of land value, and a 656-foot lock constructed at a cost of $133,280.

The project contemplates the eventual linking of these three stations by a high-tension transmission line to cost $226,100. The total power which the combined plant will then be capable of delivering is 41 million kilowatt-hours a year. As the maximum water flow available during the various seasons does not coincide, however, with the fluctuations in the demand for power, it is calculated that a yearly consumption of 29 million kilowatt-hours can be taken care of without resort to a steam reserve. The prospective initial demand does not warrant so large a plant, and it is proposed accordingly to build only the Hemfurt and Helminghausen stations at present and to connect these with the steam-driven, electric-generating plant of the Prussian railway administration at Cassel, and possibly also with the municipal steam plants at Cassel and Gottingen, from which supplementary power can be drawn as the need arises.

It is considered that the interests of the local inhabitants will be better served if the State itself delivers the power to the surrounding county governments for further distribution than if it is sold at once and entire to some private distributing concern. Direct sales will be made to the Prussian railway establishment at Cassel (for use in the station, yards, shops, etc.), and also, it is expected, to the cities of Cassel and Gottingen. Under the proposed arrangement the existing steam plants at these points will be allowed to remain idle except when, owing to low water or heavy demand, they are called upon to assist the water-power stations. Electricity will be sold to the two cities and the railway administration at 0.714 cent per kilowatt-hour and purchased from them when needed at 1.428 cents. According to estimate, it will be necessary at the outset to buy only two to three per cent of the total power consumed in any year not attended by unusual water conditions. It is possible that in the future direct sales will be made to other larger establishments, such as manufacturing plants, etc., but for the present, except in the three instances noted, the power will not be sold to ultimate consumers, but to the county governments or to companies formed in one or more counties under special provisions of law.

The region to be served includes 13 counties in Prussia and 3 in Waldeck, representing a total area of about 2,500 square miles and embracing a population of about 600,000. It is estimated that approximately three-fourths of the prospective demand will be municipal and industrial and one-fourth agricultural. The current will be distributed to 15 points within this region by means of a 40,000-volt transmission system, which will be about 215 miles in total length and will cost to construct about $405,000. At each of the 15 points mentioned there will be a transformer station, where the current will be stepped down from 40,000 to 6,000 volts and delivered to the county governments or companies.

Calculated on the basis of five stages in the growth of demand, the cost of the electricity to the State at the transformer-station switchboards will be as follows:

Stage	Yearly consumption. Kilowatt-hours.	Per kilowatt-hour. Cents.
First	10,000,000	1.2
Second	20,000,000	.862
Third	24,000,000	.888
Fourth	30,000,000	.807
Fifth	40,000,000	.745

The Munden station will be built when the consumption approaches 24,000,000 kilowatt-hours, so that the higher per-unit cost at that stage, attributable to the necessity of purchasing large quantities of steam-generated electricity, will never be actually encountered.

On the basis of these cost calculations it is proposed to sell electricity to the counties at 1,428, 1.19, and 0.952 cents (6, 5 and 4 pfennigs) per kilowatt-hour, according to the amount consumed. Forty-year contracts are being made, by the terms of which the counties or special companies formed therein undertake to purchase minimum amounts of power at the prices named and to distribute it to the ultimate consumers at 220 or 120 volts, as conditions require. They will be able to do this profitably, according to estimates, at 10.7 cents per kilowatt-hour for light and 4.76 cents for power to small consumers and at considerably reduced rates to large consumers. The cost to the counties or companies of the equipment and installation for this final distribution is roughly estimated at $3,300,000 to $3,800,000 or on the average about $238,000 for each county.

The investment by the State includes the generating plant and the high-tension transmission system. The original bill laid before the legislature appropriated for this purpose $2,142,000. This was finally amended by increasing the amount by $357,000.

BOOK REVIEW.

"Electrical Meters." By Cyril M. Jansky. New York: McGraw-Hill Book Company. Cloth, 370 pages (6x9 inches), illustrated. Supplied by the Electrical Review Publishing Company for $2.50.

This book covers nearly the whole range of commercial electrical measurements. While written primarily as a textbook it should also appeal not only to the central-station man but to electrical engineers generally who have directly to do with measuring instruments. While necessarily a large portion of the book (about two-fifths) is devoted to the different types of watt-hour meters, their errors and methods of testing, the leading commercial types of ammeters, voltmeters, wattmeters, power-factor and frequency meters, synchroscopes, graphic instruments, ampere-hour meters, and demand indicators are described in considerable detail. The discussion is limited almost entirely to American practice. Methods of testing the different types of instruments, standard instruments, and various equipments for such testing are given a somewhat detailed consideration. A special chapter is devoted to methods for obtaining different power-factors, among which is a simple one devised by the author which makes use of but two ammeters in either a two-phase or a three-phase circuit. It is said to give sufficiently accurate results for commercial work. A separate chapter is also devoted to instrument errors.

In the first chapter on fundamental principles the treatment of Ohm's law deserves particular mention as the statement of it is perfectly general, while following the form originally given it by Ohm. "The current strength in any circuit is directly proportional to the sum of all the electromotive forces in the circuit. . . . This holds for both direct and alternating-current circuits so long as the physical conditions surrounding the circuit remain unchanged." Or, $E = K I$. For direct currents K becomes the resistance.

Considering the range of work covered, it is not strange that there are a few points which should be retouched in a later edition. Unsaturated Weston cells, instead of primary saturated cells, should be used in practically all potentiometer work. An inexperienced reader might get the idea from pages 117 and 124 that shunting a wattmeter is good practice. The old error is repeated, (curiously enough with an apparent but erroneous proof), that Hooke's law may be circumvented by using an auxiliary spring which opposes the main spring at small deflections. It is easily shown that such an arrangement obeys Hooke's law, hence the arrangement is worse than useless. In the opinion of the reviewer both the importance and the accuracy of the mercury ammeter are decidedly overestimated.

P. G. Agnew.

New Electrical and Mechanical Appliances

Wotton Automatic Battery-Charging Equipments.

The great interest being manifested in the electric vehicle has aroused attention in various means for simplifying and insuring the proper charging of vehicle storage batteries. To meet this need the Electric Products Company, of Cleveland, O., has devoted itself for some time and has brought out several very successful automatic charging panels and complete charging equipments.

Fig. 1 shows the Wotton automatic rectifier and charging panel designed for charging vehicle batteries at home from single-phase alternating-current circuits. This equipment is very compact and extremely simple in operation. A mercury-arc rectifier is mounted at the top back of the panel. The charging current can be closely adjusted and it automatically diminishes as the charge proceeds, a condition highly favorable to lead storage batteries particularly. The instrument on the panel is both an indicator and automatic cutoff to stop the charge when complete. One pointer is placed at the exact point representing the fully charged condition of the battery. The other pointer gradually moves across the scale as the charge progresses and when the two pointers come in contact the charging circuit is automatically opened. The two pointers remain in contact as an indication showing that the charge was not stopped by any trouble on the line and that the battery is fully charged. This system therefore protects the battery both from undercharge and overcharge and is entirely automatic, this relieving the owner of the car from worrying whether the battery is being properly charged.

In Fig. 2 is shown an equipment for larger installations, in this particular case being designed for a private garage that can accommodate six vehicles or trucks on charge at one time. In this equipment a motor-generator set is provided and each vehicle circuit has set apart for it a separate panel embodying similar equipment to that shown in Fig. 1, except for the rectifier and the form of the switches and regulator. Each circuit has an automatic cutoff to discontinue the charge when its particular battery is fully charged. When the last of the six battery sets has been cut off from charge the motor-generator set is also automatically stopped, thus preventing any waste of energy in idle running of the machines.

A non-automatic equipment is shown in Fig. 3. This is intended for public garages in which an attendant is always present. This is a comprehensive outfit in that it is adapted for charging and discharging any number of cars up to its total capacity of 10 circuits. It enables the garage owner to save all the current that ordinarily goes to waste in the forming up of new batteries or the working up of others that have been neglected. By appropriate receptacles the condition of each separate battery can be read on the instruments at the top of the board. This outfit is almost indispensable in a public garage of any consequence because of the current saving and reduction in labor it actually brings about.

Another feature developed by the Electric Products Company is a transfer panel that permits arranging several low-voltage batteries on the same circuit so as to avoid the considerable energy losses in rheostats which are inevitable when, say, a 24-volt battery is connected to a 110-volt charging circuit.

Fig. 1. Automatic Rectifier and Charging Panel for Private Garage.

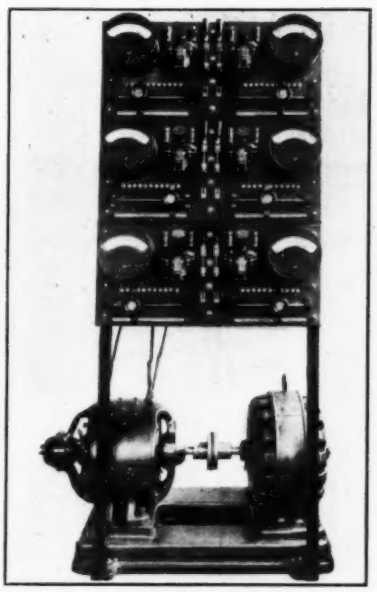


Fig. 2. Motor-Generator and Automatic Charging Panels for Six Cars.

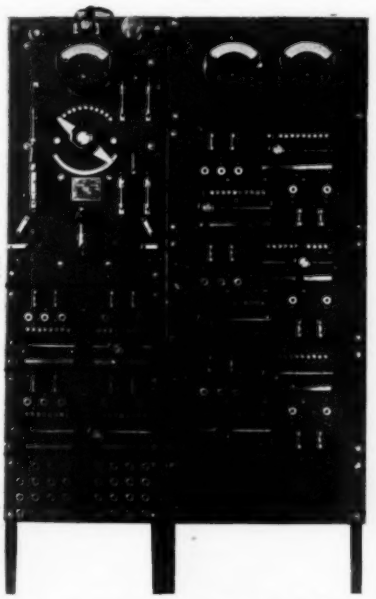


Fig. 3. Non-Automatic Charging and Discharging Panels for Ten Cars.

The Graphometer.

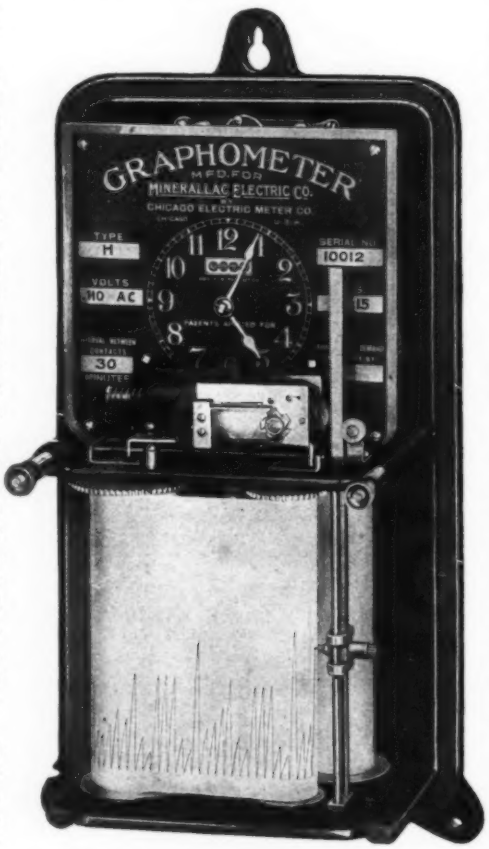
The Chicago Electric Meter Company, whose specialty is the manufacture of maximum-demand devices, has developed a device based upon inventions of Charles H. Merz, Simon B. Storer and others, that will give a record based, like those of its Printometer and Maxicator, on the modern principle of measuring the demand, that is, the average demand during a definite time interval, but instead of printing or indicating it this new instrument records the demand on a chart so that it will be possible to see at a glance the maximum demand, the time it occurs and its relation to other load conditions during the month. This is the form of record obtained by the Graphometer.

Other forms of graphical records are instantaneous and show extreme peaks and rapid variations of load, which are not practicable in charging for electricity. With instantaneous records it is necessary to approximate the average consumption for each interval and then use this average in figuring the bill, which procedure is naturally laborious, difficult and very inaccurate, while the Graphometer gives this average automatically and draws the record ready for immediate use.

The Graphometer is connected to the watt-hour meter by means of three small wires which lead to a contact-making device on the register of the watt-hour meter. This device closes the circuit on a solenoid connected to a rack carrying a stylus on the Graphometer. Each operation of the solenoid advances the stylus on the instrument.

This stylus while advancing is in contact with a treated paper chart, which is being driven forward at right angles to the stylus, at a definite speed, by means of a high-power clock contained within the Graphometer. The stylus will, therefore, continue to be driven upward for each operation of the contact-making device on the watt-hour meter register, the height of this line representing kilowatt-hours, and the paper will move forward steadily at right angles thereto, the base line of this portion of the chart representing the time. Then at the end of the interval for which the demand is to be taken, say for instance 30 minutes, the carriage holding the solenoid will become disengaged from the rack carrying the stylus and will allow it to return to the bottom of the chart or the zero position, where the same series of operations will begin for the next interval. The highest point reached on the chart by the stylus during the month will, therefore, be the maximum demand for the month and may be read directly in kilowatts. Since the total consumption is obtained from the watt-hour meter dials the combination of the Graphometer with the watt-hour meter will give both the total consumption and maximum demand for the month, and will show the time it occurs.

The Graphometer is extremely simple in construction and there are no complicated mechanisms to get out of adjustment and give trouble. There is no pen-and-ink arrangement used, since experience has shown that under even the best of conditions these give trouble. The solenoid which is used to advance the stylus may be operated from any one of the following sources: 110 or 220 volts alternating current, 18 or 110 volts direct curent. The instrument can be set for demand intervals as follows: 5, 10, 15, 20, 30 or 60 minutes.



The Graphometer for Recording Maximum Demand.

The charts used with the Graphometer are six inches wide and are advanced one-fourth inch per hour, so that a one week's record will be approximately 3.5 feet long.

The Graphometer may be applied to any watt-hour meter regardless of the make, type or capacity, thus not requiring additional or duplicate meter investment, but permitting the use of the present watt-hour meters in which the capital has already been invested, and also one type of maximum-demand device with any watt-hour meter on the system.

The record obtained with the Graphometer, in addition to being based on the the most modern method, is absolutely accurate, since the device is electrically interlocked with the watt-hour meter and depends solely on the calibration of the latter for its accuracy; and the time is also accurate, since this element of the device is mechanically interlocked with a high-grade clock and differs from all other curve-drawing devices in that the time is not dependent upon the speed of travel of the paper, but only upon the length of time between each return of the stylus to the base line or zero point. This gives an absolutely definite time interval. In all other devices, with the exception of the Printometer and the Maxicator, the time interval is not definite and positive and this interval is either estimated or assumed in one way or another.

American Machinery for Extension of Cauvery Falls Water-Power Plant in India.

United States Consul Henry D. Baker, on special service in India, has sent the following interesting report.

Construction has just been started on an important extension to the famous water-power scheme at the Cauvery Falls in the native State of Mysore, from which at present 10,000 horsepower is electrically transmitted 92 miles to the Kolar gold fields, and about 2,000 horsepower somewhat lesser distances to the two cities of Bangalore and Mysore, where it is used for electric lighting and industrial purposes. The new extension will increase the water power available for the gold mines at Kolar by 7,000 horsepower, and also will permit a fair increase in the power for use at factories in Bangalore. The original installation, which was made in 1900, cost $2,866,667, and the new electrical installation will cost $466,667.

There is, however, to be a further large expenditure of about $2,666,667 on a huge dam and reservoir across the Cauvery River at the town of Kannambadi, about 15 miles distant from the city of Mysore. This is to be used both for increased water power and for irrigation. It is anticipated that its construction will not only insure the steady supply of water the year round for power for industrial purposes and for existing irrigation in the Cauvery River valley, but it will also allow for an increase power supply as future demands arise, and also for additional irrigation to the extent of 150,000 acres. The dam will have a total height of 124 feet above the river bed when com-

pleted. The depth of storage will be 118 feet. The work will be constructed in two stages. In the first stage the dam will be raised to a height of 97 feet, so as to store a depth of 80 feet of water or 11,030 million cubic feet

All the electrical equipment for the new installation will be manufactured in the United States. Already a contract has been signed for the purchase of two 1,500-kilowatt generators and twenty 1,750-kilowatt high-voltage transformers, together with switchboard gear, to be supplied from Schenectady, N. Y., at a cost of about $150,000. Leading electrical firms in England and Germany bid competitively with American firms on this equipment, but the English bids were about 20 per cent higher than the accepted bid of the American firm, and in the case of German firms their guaranties were not considered so satisfactory as to those of the American firm. The new turbine installation, as in the original plant, will be from Zurich, Switzerland. In the new installation the voltage will be raised from 35,000 to 70,000 volts.

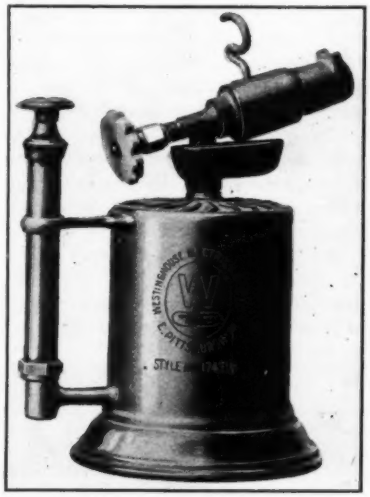
An interesting feature of the new high tension line installation will be the use of iron cross-arms having porcelain insulators, which are to be supplied from Pittsburgh, Pa., at a cost of $200,000. This iron-pole construction is deemed advantageous on account of the white-ant difficulty with timber, and also because of local scarcity of tall enough trees for poles.

The first Cauvery Falls water-power scheme was at the time of its inception one of the most important long-distance transmissions in the world, and attracted much special interest in the United States at the time because it was one of the first notable instances of American manufacturers and American engineers participating so prominently in a great project so far from home. This scheme was originally carried out, and has always been subsequently managed by American engineers appointed for this purpose by the Government of Mysore, and the electrical equipment, which has always proved most satisfactory, was all manufactured in the United States. The present electrical engineer in charge, and who will also direct the new installation, is C. F. Beames, a citizen of New York State.

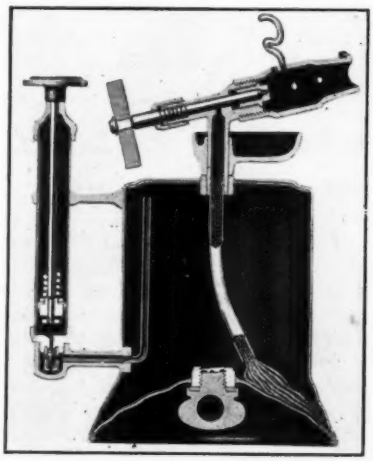
Very brilliant financial results to the Mysore Government have followed this enterprising undertaking. The original capital outlay has now been practically all covered in subsequent profits. The plant is now netting in earnings about $500,000 a year, which is a substantial source of revenue. The charge to customers for power is about $50 per unit horsepower per year. A large agumentation of the profits is anticipated from the additional installation.

A Universal Blow Torch.

A new gasoline blow torch has recently been placed on the market by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., which embodies a number of novel features and improvements. These improvements, it is claimed, adapt the torch for all conditions of service and it is therefore called a universal blow torch. A perspective view of the torch and a cross-sectional diagram of same are shown in the accompanying illustrations.



Universal Blow Torch.



Cross-Section of Torch.

The burner is made particularly heavy so that it will retain its heat and keep the torch burning in cold or windy weather. The drip cup is made especially deep so that it will start the torch under bad weather conditions. These features, however, do not detract from the use of the torch for indoor work. Another feature of the torch is the self-cleaning burner valve. The needle at the end of the valve stem cleans the hole automatically when the valve handle is turned. The valve seat, therefore, need never be injured by picking at the opening to clean it. The valve seat is a separate replaceable plug.

The handle of the valve is of fiber. This handle does not get hot nor does it need a long valve stem for cooling as does an iron handle. On the other hand it will not crack, loosen and come off, as does a wooden handle. It does not char nor burn. The tank, it is claimed, is of the heaviest gauge brass ever used for torch tanks and is reinforced with an extra corrugated brass disk covering the entire inner surface of the tank pot. This insures the tank keeping its shape under very rough handling. The pump valve works in a cylindrical guide which assures the perfect seating of the valve. It can be taken apart and any part replaced separately.

The illustrations show the quart size of torch. A pint size is also furnished, which differs only in the shape and size of the tank.

Electric Block-Signal System for Santa Fe Railway.

The announcement has been made by Chief Engineer Harris of the Santa Fe Railway Company that within a few weeks the company will begin the installation of a block-signal system of the electrically operated type along all double track now existent and under construction between Los Angeles, Cal., and Albuquerque, N. M. Mr. Harris has been in Los Angeles for some time making arrangements to receive bids on the work in connection with the new mechanical terminals. The cost of the proposed work has not as yet been ascertained, but it is known that the electric blocking system will be used to protect 362 miles of double track, equivalent to 724 miles of single line.

Wyoming Coal.

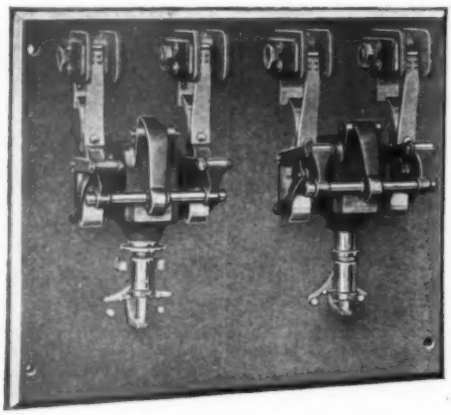
The coal production of Wyoming in 1912 amounted to 7,368,124 short tons, valued at $11,648,088, an increase of 623,260 short tons over the figures of 1911.

Probably more than half of the entire area of Wyoming is coal-bearing. Coal is believed to exist in every county of the state, although in some portions it lies under so heavy a cover as to be unworkable under present conditions. The reserves are estimated at approximately 424,000,000,000 short tons, a supply exceeding that of any other state, with the possible exception of North Dakota. Some of the Wyoming coals go to markets as far distant as the Pacific coast. The coal fields of Wyoming are numerous and some of them are very large.

Automatically Switching Apparatus to Auxiliary Supply Mains.

The maintenance of continuity of electric power service to electrical machinery, lighting circuits, signal apparatus, etc., make it imperative that means be provided for switching on reserve power instantly to supply current in case of failure of the main source of power. The circuit-breaker shown in the illustration is designed for just such service, and yet is so simple in construction and in operation that it is believed to be thoroughly dependable.

It consists of two double-pole, single-coil, solenoid-operated, magnetic-blowout circuit-breakers, each of which remains closed only while the current is on the solenoid, and drops out by gravity when this current is interrupted. The circuit-breaker on the left is in the main supply circuit and, under normal operating conditions, is closed; the one on the right is open.



Automatic Circuit-Breakers for Connecting Auxiliary Supply.

When the main source of supply fails, the circuit-breaker on the left opens, owing to its solenoid being deënergized and the metallic disk directly underneath this solenoid and fastened to its core bridges the gap between the two rectangular contact blocks just below it as the core falls. The closing of this circuit connects the operating coil of the circuit-breaker on the right across a storage battery or other auxiliary source of current, and energizes its solenoid which instantly forces the circuit-breaker closed and permits current to be supplied from the auxiliary source of power, thus avoiding any interruption of service. When the regular power service is restored, the solenoid of the circuit-breaker on the left is again energized, causing the circuit-breaker disk to be withdrawn from the rectangular contact blocks, this action breaking the circuit of the solenoid of the circuit-breaker on the right, which latter opens at once, cutting off the supply of current from the auxiliary power source.

The circuit-breaker at the left of the illustration will be closed at all times except when the regular power supply fails and the apparatus must be switched on to the auxiliary source of power. The interruption due to the change from one line to the other lasts merely a fraction of a second and so operation is practically continuous regardless of the number of changes of the supply circuit.

As stated above, the circuit-breakers remain closed only when held in that position by their solenoids. Since less current is required to hold the circuit-breakers closed than to close them, they have been so designed that a resistance is introduced in series with the operating coil immediately after the circuit-breaker is closed. This permits the use of the requisite amount of current for closing and then reduces it to a minimum, making it possible to use a coil of small continuous current-carrying capacity and also rendering negligible the loss of power in holding the circuit-breaker closed.

Each circuit-breaker is provided with a dashpot and a set of auxiliary contacts to which latter are connected the terminals of a resistance. The auxiliary contacts are bridged when the circuit-breaker is open, thus cutting out the resistance. When the plunger in the dashpot rises as the circuit-breaker closes, the bridge across the auxiliary contacts is removed, and thus resistance is connected in series with the operating coil. This resistance is not cut in, however, until the circuit-breaker is completely closed, because the dashpot introduces a time interval between the closing of the circuit-breaker and the opening of the auxiliary contacts.

The circuit-breaker described above is manufactured by the General Electric Company, Schenectady, N. Y.

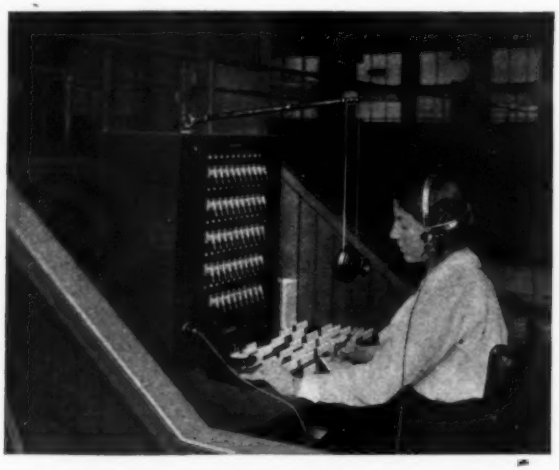
Computing Costs by Aid of Telephone.

A unique use for the telephone has been arranged for Marshall Field & Company's large retail store in Chicago, where a number of special switchboards and 150 telephones have been installed by the Western Electric Company for the sole purpose of determining the cost of altering and repairing garments.

A large number of garments come into the work rooms for alterations. Experience proved that it was unsatisfactory from an efficiency standpoint to have the operatives make out time cards for each garment. The records obtained in this way were inaccurate and unreliable and no exact costs could be obtained therefrom.

Therefore, it was considered necessary to devise a method of keeping accurate records which would reduce to a minimum the operative's part in the proceedings.

All garments receive a job number before they are sent into the work room.



Special Cost-Keeping Telephone Switchboard in Marshall Field & Company's Retail Store.

They are then distributed to the operatives, each of whom has a telephone near at hand. When the work of repairing or altering is started, the operative takes the telephone receiver off the hook and says: "I am starting work on job number — — —." This time is recorded on a job ticket by means of a time stamp controlled by a girl at the switchboard with which the telephone is connected. This operator has no other duties to perform. When the repair or alteration has been completed, the operative again takes up the receiver and says: "Job number — — — is completed." Again the time is recorded by the switchboard operator. The elapsed time gives an accurate basis for computing the cost of the work done in altering or repairing the garment.

The switchboards are of the lamp-signal type and there are no cords and plugs used. When the garment worker takes up the telephone receiver, a small incandescent lamp lights up in the face of the switchboard. By working a key

the operator is at once enabled to listen in on the line.

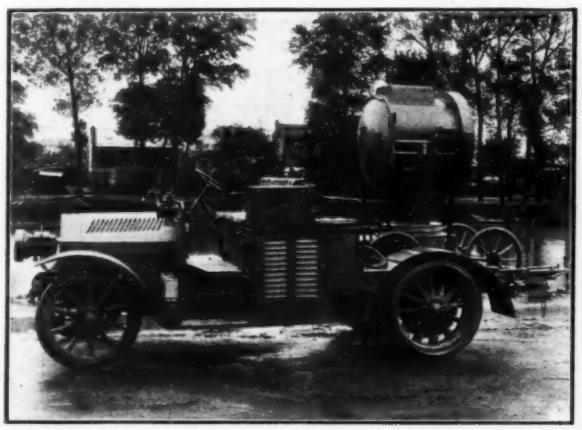
This cost-computing telephone system is entirely distinct and separate from any other telephone system in the building. It is estimated that it will be the means of saving thousands of dollars a year in just this one department.

This is but another instance of the remarkable versatility of the telephone and its increasing use in every phase of industrial development.

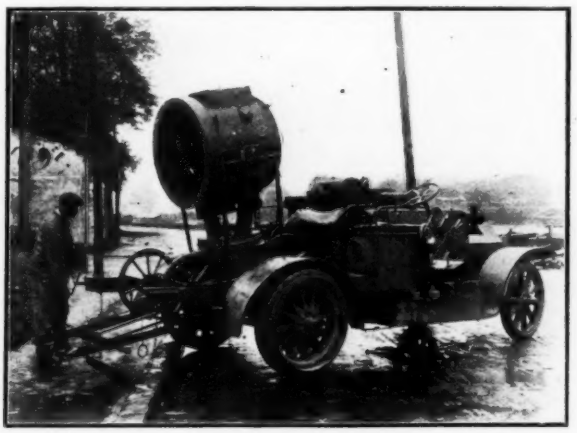
A New French Military Searchlight.

The French army is making a constant endeavor to design power cars for all kinds of military uses to which these can be put, recognizing that modern progress lies in this direction. As an example there are the recent types of military searchlight for campaign work, which are constantly being improved as time goes on in order to keep up to the latest ideas. The Aries automobile searchlight, which is shown herewith, is a recent production resulting from combined designs of the military engineer corps and one of the well known Paris automobile establishments which has already been engaged in constructing military power wagons and trucks of high efficiency for some time past. Somewhat the same truck is used in the present case this being modified in some degree to suit the needs of the searchlight, especially as the car engine now requires to be coupled to a dynamo of good size for supplying current. The dynamo with its accessory fittings is mounted in a well-protected box occupying the central part of the car, and this box also seems to hold the two seats, one double seat in front for the drivers and a single one in the rear for the man operating the searchlight.

The design of this latter presents several points of difference from the ones which are already in service. As in all the recent military searchlights, the projector is designed so that it can be operated while in a fixed position upon the car, or in other cases it is separated and run off to a distance from the car; for this purpose the projector is mounted upon a light four-wheel truck. In some cases the projector may need to be taken to a point where the automobile cannot be run, so that the use of a wheeled carriage is in fact a necessity in order to get the best possible use out of the combination. To run off the projector carriage, all that is needed is to let down the pair of small channel-bar rails upon which the carriage rests in the normal position, at the same time drawing out these rails so that they touch ground, this movement as well as the lowering of the carriage being done by a winch. The projector is then run to a certain distance, being connected by cable so as to receive current. All the movements of the searchlight are given by electric devices contained within its base, so that these can be controlled from the car itself by the use of a second set of cables, allowing it to be rotated and inclined, and also eclipsed by an electric shutter.



Portable Military Searchlight.



Removing Searchlight from Car.

New Pass & Seymour Rosettes.

Although the use of drop cords has largely gone out of fashion, there are still a great many places where they must be installed for various reasons. When used in connection with conduit wiring systems there is need of having special covers for the outlet boxes to act as rosettes do in molding work. A simple and convenient line of such covers or rosettes particularly designed for use on outlet boxes has been placed on the market by Pass & Seymour, Incorporated, Solvay, N. Y. Fig. 1 shows the No. 1172 design which is for use on any of the 3-inch or 3.25-inch boxes. Fig. 2 shows the No. 1173 type which fits any of the standard 4-inch boxes. Each of these covers or rosettes is shipped in a neat pasteboard carton complete with necessary screws for immediate attachment to the outlet box.

Fig. 1.

Fig. 2.

Telephone Train Dispatching on the Denver & Rio Grande Railway.

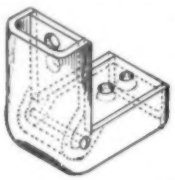
The telephone will replace the telegraph for dispatching work on the Denver & Rio Grande Railway system. Construction gangs have started installing a special and private telephone system between Grand Junction, Colo., and Ogden, Utah. For this purpose two heavy copper wires will be strung a distance of 328 miles at an expense of upward of $50,000. It will require between 60 and 90 days to complete the work.

This system makes it possible to establish instantaneous connection between dispatching headquarters and trainmen. Not only will side tracks and blind sidings be equipped with telephone boxes, but all trains will carry instruments enabling trainmen to make connection at any point between telephone stations. Delays to trains occasioned by unlooked-for interruption of any character will be minimized and the dispatching of trains expedited far beyond present possibilities. The heavily worked telegraph wires will also be relieved of much of their present burden.

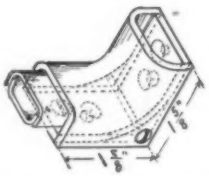
Aluminum foil has replaced tin foil to a considerable extent in the manufacture of electrical condensers.

Fancleve Cast Elbows for Metal Molding.

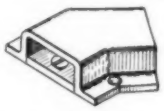
The accompanying cuts illustrate some cast elbows for use with National metal molding. Among the special features possessed by these new fittings is the fact that the metal is sufficiently thick to cut several threads for the attaching machine screws, whereas the stamped metal is only capable of having one and one-half threads cut. The internal and external styles form a perfect square at any 90-degree angle wired over, and the cappings cannot shake off owing to a stove bolt passing through the cap, contiguous to the back of the base. Separate holes are provided for wood screws to attach the base to the surface wired over, and others tapped for machine screws to confine the base of the molding to the base of the elbow. The No. 910 elbow is for 90-degree external or evolute bends; No. 911 is for 90-degree internal or involute bends; No. 912 is for 45-degree bends, right or left, on a plane surface, and is tapped and drilled the same as the 90-degree elbows but the holes do not appear in the perspective shown herewith. The flanges on the 45-degree elbow are applied to the surface by wood screws rather than a stove bolt, one on the short flange and two on the long flange. These elbows are made by the Fancleve Specialty Company, Boston, Mass.



External or Evolute Elbow.



Internal or Involute Elbow.



Forty-five-Degree Elbow.

Further silk-mill electrification is to be carried out at Leek, England, where a preliminary plant enables the managers to plan extensions making it possible to produce electrical energy at not over 1.1 cents per kilowatt-hour.

Latest Approved Fittings

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

CABINETS.—Electric Apparatus Company, 127-129 South Green Street, Chicago, Ill.
Approved June 13, 1913.

CLAMPS FOR FLEXIBLE TUBING.—New Process Specialty Company, 709 M. & M. Bank Building, Milwaukee, Wis.
Flexible tubing clamps. Pressed-metal clamps for supporting flexible tubing and holding the same at outlets.
Type A clamp; for use at combination gas and electric outlets.
Type B clamp; for use at straight electric outlets.
Approved May 28, 1913.

CABLES, Armored.—Eastern Flexible Conduit Company, 41-59 Gardner Avenue, Brooklyn, N. Y.
Approved June 13, 1913.

CONDUIT BOXES, Floor Outlet.—H. Krantz Manufacturing Company, 160-166 Seventh Street, Brooklyn, N. Y.
Catalog No. "Fountain's 250."
Catalog No. "Fountain's 260."
Catalog No. "Fountain's Acme No. 1."
Catalog No. "Fountain's Acme No. 2."
Catalog No. "Fountain's Gem."
Approved May 29, 1913.

CUTOUT BASES, Plug Fuse.—Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.
Edison type receptacles, with left-handed threads, mounted on porcelain bases. For use in connection with specially designed fuse casings. O-2 amperes, 250 volts.
Style No. 151199 single-pole.
Style No. 151200 double-pole.
Style No. 171597 triple-pole.
Approved June 12, 1913.

FIXTURE WIRE.—Imperial Wire & Cable Company, Limited, Montreal, Canada.
Marking: Yellow thread woven in braid, or one blue, green or black thread in a red braid.
Approved June 11, 1913.

FUSES, Plug.—Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.
Edison type porcelain fuse casing, with left-handed threads, containing a standard cartridge fuse, ferrule type. For use in connection with specially designed cutout bases. O-2 amperes, 250 volts.
Approved June 12, 1913.

SWITCHES, Push-Button Flush.—Manhattan Electrical Supply Company, 17 Park Place, New York, N. Y.
Four-way, 5-ampere, 250-volt; 10 ampere, 125 volts. Catalog No. 5006.
Approved June 6, 1913.

SWITCHES, Automatic.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis.
Floor-stop device. Bulletin No. 7805.
Protective devices, for use with battery charging rheostats, Bulletin No. 8550.
Approved May 28, 1913.

SWITCHES, Push-Button Flush.—Union Electric Company, Hamilton Avenue and Clark Street, Trenton, N. J.
Single-pole; Catalog No. 800.
Double-pole; Catalog No. 801.
Three-way; Catalog No. 802.
Approved June 4, 1913.

WIRE CONNECTOR.—U. S. E. M. Company, 221 West Thirty-third Street, New York, N. Y.
"USEM" wire connector; consisting of a brass thimble and steel screw inclosed in a casing of molded insulating material.
Following are the general conclusions from Laboratory tests and investigation to date: These connectors are judged to be suitable for use in connecting fixture wires to the supply circuits at fixture outlets, and where open to view for connecting motor leads to supply circuits. They are not considered satisfactory as a substitute for soldered joints in general wiring. They are not suitable for use with wires larger than No. 12 B. & S. gauge.
Approved May 1, 1913.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

GRAND FORKS, N. D.—Plans are being considered for extending the lighting system. C.

REYNOLDS, GA.—J. A. Matthews, mayor, contemplates installing an electric light plant here.

BELLEVUE, IOWA.—$600 has been voted to put in boulevard lights, consisting of about 35 electroliers. C.

LEMARS, IOWA.—The City Council is considering the installation of electroliers for the main street. C.

MARFA, TEX.—The Marfa Light & Ice Company will install an auxiliary electric light and power plant here.

DENISON, TEX.—A 30-year franchise has been granted to the Texas Light & Power Company to operate in this city.

BREWTON, ALA.—The Downing Industrial School is planning to install an electric lighting system to cost about $55,000.

GRIGGSVILLE, ILL.—The Woman's Christian Temperance Union is raising a fund to install cluster lights in the parkway. Z.

BIRMINGHAM, ALA.—The Republic Iron & Steel Company will establish an electric power plant here at a cost of $100,000.

RICHMOND, IND.—City Engineer Cluys recommends the purchase of a switchboard with its equipment for the lighting plant here.

LEXINGTON, KY.—L. H. Ramsey will install a 50-horsepower electric-light plant for use in illuminating his theater and adjoining buildings. G.

ATLANTA, GA.—The Fulton Bag & Cotton Mill will install equipment for electric drive to include three transformers and eight motors.

CEDAR FALLS, IOWA.—An ordinance has been adopted for issuance of $50,000 worth of bonds for the erection of a municipal electric plant. C.

WINONA, MINN.—Business men are organizing a "White Way" association to secure illuminated streets. James R. Kinsloe is secretary and manager. C.

MARBLE FALLS, TEX.—Steps have been taken here looking to the establishment of a municipal water works and electric light plant. D.

LAKE CITY, FLA.—$7,500 in bonds has been voted for installing an electric lighting system here. Address J. C. Young, Commissioner of Public Works.

MORRIS, ILL.—Members of the City Council made an inspection of the street lighting system at Henry, Ill. A new system is contemplated here.

ST. PAUL, MINN.—The State Board of Investment has voted to loan $8,000 to the village of North St. Paul for enlarging its water and light plant.

SANTA BARBARA, CAL.—The Santa Barbara Gas & Electric Company has applied for authority to issue $100,000 in bonds for the purpose of extending and improving its system.

LEBANON, ORE.—The City Attorney has been authorized by the City Council to prepare an ordinance for a cluster lighting system to be installed in the near future. O.

MARSHALLTOWN, IOWA.—The Lennox Furnace & Quick Action Range Company will use electrically driven machines in its new factory to be erected. Z.

ALDERSON, W. VA.—The Alderson Light & Power Company has been incorporated with a capital stock of $25,000 by W. C. Beard, G. K. Gwinn and others.

CLINTON, ILL.—Commissioner Charles Dickerson of the Waterworks Department is interested in a plan to install a municipal electric light plant at the waterworks station. Z.

LESTER, W. VA.—An electric light and power company has been incorporated here by J. Levi Cook, Tom Bryson and others, for the purpose of installing an electric lighting system in Lester.

VANCOUVER, B. C.—Ward Three Rate Payers Association recently passed a resolution asking the City Council to take steps toward the establishment of a municipally owned electric light plant.

CLARKSBURG, W. VA.—The Clarksburg Gas & Electric Company is having plans prepared by S. F. Martin, Penn Building, Pittsburgh, Pa., for a central power plant to cost about $100,000.

CORVALLIS, ORE.—At a recent special election the proposition of building a municipal power and light plant carried by a big majority. The matter of construction will be put up to the incoming Council. O.

WINTER PARK, FLA.—H. A. Ward, chairman, Finance Committee of the City Council, has received bids for the $10,000 worth of bonds which were decided upon for the installation of an electric light plant.

HILLSBORO, ILL.—The Southern Illinois Light & Power Company has purchased the electric light plant at O'Fallon. The plant there will be dismantled and a transmission line will be built from Collinsville. Z.

GASTONIA, N. C.—The Clara Manufacturing Company will purchase new electrical equipment consisting of five 20-horsepower and one 50-horsepower motors, two 125-volt transformers, switchboard and accessories.

POUGHKEEPSIE, N. Y.—This city is considering the advisability of owning a municipal lighting plant. It is estimated that an investment of $100,000 in a municipal electric light plant will save the city a considerable sum each year.

KELSO, WASH.—The Washington-Oregon Corporation was recently awarded the contract for furnishing light and water and power in this city for a period of one year. It is understood some construction work will be done shortly.

WARREN, PA.—It is stated that $125,000 of a recent appropriation made by the Legislature for improvements to the State Hospital at North Warren will be used for building and equipping a power plant for the heating of that institution.

MONTESANO, WASH.—F. Norton Babo and F. L. Harung have been granted a franchise by the City Council to construct and operate an electric light plant and water system in this city. Work of construction will be started in the immediate future. O.

GLENDALE, CAL.—City Electrician Harry B. Lynch, of this place, is contemplating the erection of an ornamental lighting system on several streets of this city. This system will not be elaborate, but it is expected that it will cost between $15,000 and $20,000.

KIRKLAND, WASH.—This city recently granted the Puget Sound Traction, Light & Power Company, of Seattle, Wash., a franchise to construct and maintain a transmission line for furnishing light and power to this city, for a period of 50 years. Work of installation will begin in the immediate future. O.

ITASCA, TEX.—A 50-year franchise has been granted to the Texas Power & Light Company. The company will give 24-hour service, the present plant being used until rewiring can be done and a transformer station installed. It is expected that some $12,000 will be expended on improvements.

CENTRALIA, WASH.—The Washington Oregon Corporation, purveyors of electric power to practically every small town in the Southwestern portion of Washington, recently purchased the electric light plant at Woodland from William Lawlor. The new owners will spend a considerable sum in improving the plant.

LOS ANGELES, CAL.—Acting City Electrician Manahan has presented plans to the Board of Public Works of this city, which have been accepted, for the ornamental lighting system of Olive Street between Sixth and Pico Streets, a distance of seven blocks. Bids for this work are now being received. T.

LOUISVILLE, KY.—The Louisville Gas & Electric Company is planning to take up with the Louisville Railway Company the matter of supplying it with current. The idea was broached about a year ago, but was not received with favor by the traction interests, which have a new power plant in course of erection. The central station has been making some investigation to determine the amount of current required. G.

ABERDEEN, WASH.—The Fire &

Light Committee of the City Council recently recommended to the Council that a municipal lighting plant be constructed at the falls of the Wishkah River. It is reported definite steps towards the construction of a plant will be taken very shortly. Peter Clark is city clerk. O.

NORTH YAKIMA, WASH.—The Pacific Power & Light Company, according to D. F. McGee, chief engineer, will build a 3,500-horsepower plant in the Naches Valley, to be used as an auxiliary to the power plant under construction near Naches City, which will be ready for use August 1. Work on the auxiliary will begin at once. O.

ENOSBURY FALLS, VT.—A corporation to be known as Enosbury Falls Mills has been incorporated with a capital stock of $10,000. The incorporators are W. V. Phelps, J. B. Kimball, A. S. Armstrong, J. C. Kimball, C. S. Forsyth, C. Burt and E. E. Beauty. The company will develop electric power for use in this place.

TRENTON, N. J.—Because of the alleged high rates and uncertain service of the Public Service Corporation the merchants and business men of this city are interested in a proposition to start an independent lighting plant in this city. The plant is to be erected by Ogden D. Wilkinson, of Philadelphia, who is the largest property owner in the city. N.

DAVENPORT, WASH.—The Washington Water Power Company will construct a new power transmission line for the purpose of providing power and light to Creston, Wilbur, Almira, Hartline, Coulee City, and Ephrata, by way of Davenport. J. C. McKennett, Right of Way Agent for the Company, is engaged at the present time in securing right of way.

LEBANON, ORE.—The City Council recently passed a resolution authorizing the City Attorney to prepare an ordinance for the city to enter into a contract with the Light & Water Company, whereby the Company will furnish necessary electricity for cluster lights. These lights will be installed on Main, Sherman and Grant Streets. Bids for the fixtures and installation will be received shortly. O.

MOSCOW, IDAHO.—The properties of the Idaho-Washington Light & Water Company here were recently purchased by the Washington Water Power Company, of which D. L. Huntington is president. These properties include the electric light and power companies at Tekoa, Farmington, Pullman, Palouse, Garfield, Union Town, Oaksdale, Genesee, Colton, Troy, Moscow and St. Marie. Many improvements of a costly nature are planned. O.

COLFAX, WASH.—The Washington Water Power Company plans considerable extension of its power and light lines in Whitman County during the next few months. An extension from this city to St. Johns, via Diamond and Endicott, will be the first to be made. The City Council of Endicott recently passed an ordinance granting the Company a franchise to operate in that city, and work will soon be started there.

VERNON, B. C.—The City Council has unanimously approved of the proposition of installing the tungsten electric-lighting system on certain sections of Barnard Avenue. The Council also suggests that the system be extended to the Pleasant Valley road, providing property owners in the latter named district are agreeable. A conservative estimate places the cost of the installation at between $7,000 and $10,000. Work will be ordered shortly. O.

LEXINGTON, KY.—The Kentucky Utilities Company will extend the lines of its Middlesboro, Ky., plant to reach the grounds to be used for camping purposes by regiments of the Kentucky State Guard. It will also enlarge its plant at Pineville, Ky., to enable the coal mines in that district to be served. The company is running lines from Winchester, Ky., where it owns a plant, into the surrounding country, and expects to develop a considerable amount of business among the farmers.

TACOMA, WASH.—Superintendent of Light and Power B. W. Collins has announced that every wire on the downtown streets of Tacoma, used for carrying electric current for light, power, telegraph and telephone purposes, will be removed before the end of the summer. Plans for a new system of street lighting are being prepared by Engineer N. R. Taylor, of the City Light Department. The wires will ultimately be laid underground, but until that time, they will be strung in alleys. O.

LONG BEACH, CAL.—The Edison Electric Company has decided upon elaborate improvements at this city, including the installation of a third and a fourth unit to the company's present plant, and the installation of much other electrical machinery and apparatus. The proposed additions will increase the output of the plant several thousand horsepower. The building will have boiler generator and transformer rooms. T.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

SOUTH PASADENA, CAL.—The Home Telephone Company has been granted a 40-year franchise in this city.

SAN BERNARDINO, CAL.—Government telephone lines are to be extended from Fredalba into Green Valley.

HAMPSHIRE, ILL.—The Interstate Telephone Company has been granted a 25-year franchise by the Village Board. Z.

BOONEVILLE, MISS.—The Booneville Home Telephone Company has been incorporated by W. H. Kier, Terry Recs and others.

HOUGHTON, MICH.—It is reported that the Michigan State Telephone Company is preparing to entirely rebuild its plant in this village.

SHEBOYGAN, WIS.—The Citizens Telephone Company will make improvements costing $27,000. One thousand new telephones will be added. C.

SEATTLE, WASH.—The Pioneer Farmers Telephone Company has been granted a permit to maintain a telephone pole line on county roads.

STUTTGART, ARK.—The Rice Belt Telephone Company will expend $5,000 improving its plant, installing a switchboard, extending wires, etc.

WHEELING, W. VA.—The Consolidated Telephone Company will increase its capital stock from $3,000,000 and improve and extend its system.

SUMMERVILLE, KY.—The Summerville Telephone Company will build a rural line. It is incorporated by R. L. Morris, J. B. Estes, Dave Milby and others. G.

EATONVILLE, WASH.—The Commercial Club of this city is assisting the farmers of this vicinity in their efforts to build a telephone line in the vicinity of Silver Lake. O.

WESTFIELD, N. D.—The Overland Telephone Company has been organized with a capital stock of $10,000. The incorporators are Peter Pollock, Andrew Olson and Gerritt Van Beck, all of Westfield. C.

STANWOOD, WASH.—The Cedarhome Telephone Company recently applied to the County Commissioners for a franchise covering some four or five townships. If granted, lines will be constructed at once. O.

LEBANON, ORE.—C. H. Button, of La Grande, Ore., recently purchased the Lebanon Mutual Telephone Company from W. D. Brown and Harry Witman. It is understood some construction work will be carried on. Q.

SANDY, ORE.—The Pacific Telephone & Telegraph Company recently acquired a telephone line from this city through Cherryville to Rhododendron Tavern and will immediately begin work of constructing a new line. O.

CENTRALIA, WASH.—The County Commissioners of Lewis County recently granted a franchise to the Hanaford-Skookum Telephone Company to construct and operate a telephone line in parts of Lewis County. O.

ELGIN, ORE.—The Eastern Oregon Co-Operative Telephone Association is considering the issuance of $30,000 in bonds to be used in the construction of telephone lines in this vicinity. J. McKinnis, of Imbler, is president, and Jesse Crum, Elgin, is secretary of the company. O.

SIOUX CITY, IOWA.—Howard S. Baker, president and general manager of the Sioux City Telephone Company, states that improvements in plant and equipment of the company estimated at more than $100,000 will begin soon. Six miles of underground conduit will be laid. A large addition will be made to the switchboard and other equipment.

GLENDALE, CAL.—The Pacific Telephone & Telegraph Company has just been granted a franchise to run for a period of 50 years for the construction and maintenance of a telephone and telegraph system, the franchise being granted by the trustees of this city. In view of the fact that this right has been granted the company intends making extensions and otherwise improving its local system. T.

HONOR, MICH.—The Benzie Consolidated Telephone Company has been organized, with headquarters in this place. J. W. Cruse is president. This company has purchased the property of the Benzie County Telephone Company, the Michigan State Telephone Company and the Citizens' Telephone Company of Grand Rapids. The organization of the new company is said to mean placing the property in first-class condition.

LONG BEACH, CAL.—At a cost of over $100,000 a building is being constructed at this place which will serve as a home for the Long Beach branch of the Home Telephone & Telegraph Company. When the company moves, which time will probably be in about four months, an almost entire new station outfit will be installed, this to include switchboards, lines, cables, etc. It is the intention to make the local system one of the finest in the country. T.

ELECTRIC RAILWAYS.

(Special Correspondence.)

ANACORTES, WASH.—George W. Kreba has been granted a franchise to construct, maintain and operate a street railway. C.

OTTAWA, ILL.—The Chicago, Ottawa & Peoria Railway Company contemplates building an extension to Seatonville. Z.

BERKELEY, CAL.—The San Francisco-Oakland Terminal Railway Company is soon to be asked to make street improvements along its lines in this city.

LOS ANGELES, CAL.—The Pacific Electric Company offers to build a cut-off line to Santa Monica if residents of the beach district will secure the right of way.

WATERTOWN, MINN.—The sale of stock for the Electric Short Line is progressing rapidly and the company announces it is ready to let the contract for building the extension into Winsted, Minn. C.

STAMBAUGH, MICH.—A trolley line will be built from here to Spring Valley and Iron Mountain by the interests owning the traction and lighting systems at Ashland, Wis., Ironwood, Mich., and Hurley, Wis. C.

HILLSBORO, ILL.—Citizens at a special election approved the franchise granted by the City Council to the Springfield & Central Illinois Traction Company to construct and operate an interurban railway through the city of Hillsboro. Z.

KNOXVILLE, TENN.—A 30-year franchise has been granted to a company of which Mason Butler, of Chicago, Ill., is at the head to build an interurban electric line from Knoxville to Maryville. It is said that work is to start within six months.

SACRAMENTO, CAL.—The State Railroad Commission has just granted to the Oakland, Eastern & Antioch Railway Company the authority to issue $1,000,000 in bonds, proceeds of the sale to be used in completing the company's line between Bay Point and this city. T.

MARSHALL, MICH.—Stockholders of the Michigan & Chicago Railroad Company have authorized a bond issue for the electrification of the Allegan Division of the Michigan Central from Battle Creek to Allegan, and to install a third-rail system on the Kalamazoo-Grand Rapids line.

BRAINERD, MINN.—George I. Reid, who is promoter and temporary chairman of the Minnesota Central Railway Company, has announced that his company is perfecting plans to construct a street railway in Brainerd and a high-power electric line to link this city with the towns on the North Cuyuna iron range.

CLEBURNE, TEX.—The Dallas, Cleburne & Glen Rose Interurban Railway Company has applied to the Commissioners' Court of Johnson County for a franchise for the use of certain roads through the county for its proposed interurban electric line. It has also made application to the City Council of Cleburne for use of the city's streets. D.

OLYMPIA, WASH.—The Olympia & Southern Railroad Company has been incorporated with a capital stock of $100,000 to run either an electric or steam railroad from Olympia, on Puget Sound, to the Columbia River, in either Cowiltz or Clarke County and for a branch line from Centralia to Willapa Harbor. The incorporators are B. H. Rhodes, Centralia, and F. R. Brown, of Olympia. Z.

SACRAMENTO, CAL.—The Sacramento Valley Electric Railroad Company is to begin work within three months on the construction of the first unit of its lines which will be built from Solano City, 35 miles to Woodland, at a cost of $1,000,000. When completed the road will extend from Red Bluff to Solano City, 195 miles, through one of the heaviest freight-producing portions of California.

SEATTLE, WASH.—Scott Calhoun, receiver of the Seattle, Renton & Southern Street Railway Company, recently made an offer to the City of Seattle, to sell the right of way of the road within the city limits. If the sale is considered favorably immediate improvements, consisting of building six miles of new line into Rainier Valley points will be required. The City Council has appointed the Committee to investigate the proposition. O.

PROPOSALS.

ELECTRIC ELEVATOR PLANT.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until August 6, for an electric elevator plant in the post office at New Orleans, La., in accordance with plans and specifications, copies of which may be obtained from the custodian of the site or from the office of the Supervising Architect.

ELECTRIC MACHINE TOOLS.—Sealed proposals will be received by the Bureau of Supplies and Accounts, Washington, D. C., until August 5 for one electric traveling crane, to be delivered at the Navy Yard, Boston, Mass., as per Schedule 5,644; and a motor-driven flange-facing machine, for delivery at the Navy Yard, Philadelphia, Pa., as per Schedule 5,646.

ELECTRICAL EQUIPMENT.—Sealed proposals will be received at the office of the United States Reclamation Service, Los Angeles, Cal., until July 23, for furnishing electrical equipment for the Boise and Minidoka, Idaho, projects, including wattmeters, transformers, oil switches, air-brake switch, lightning arresters, etc. Further information may be obtained from the above office or from O. H. Ensign, consulting engineer, Washington, D. C.

ELECTRICAL WORK.—Sealed proposals will be received at the office of the Clerk of the Board of Education, City Hall, Cincinnati, O., until August 4 for furnishing all materials and doing all work necessary to complete the installation of electric lighting systems in the Whittier and Hyde Park High Schools, respectively, in accordance with plans and specifications, which may be obtained from C. W. Handman, business manager, No. 511 Court Street, Cincinnati.

ELECTRIC CONDUIT AND WIRING AND INTERIOR LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until August 19, for the electric conduit and wiring and interior lighting fixtures of a one-story building for the post office at Clarksville, Tex.; and of a one-story building for the post office at Menomonee, Wis.; until August 21 of a two-story building for the post office at Oneonta, N. Y., in accordance with drawings and specifications, copies of which may be obtained from the custodians of the sites or the office of the Supervising Architect.

WIRING AND HEATING, ETC.—Sealed proposals will be received by the Building Commission, Ohio State Reformatory for Women, Marysville, O., indorsed "Proposals on Work for the State of Ohio Reformatory for Women, at Marysville, Ohio," and sent to H. H. Shirer, secretary, 1010 Hartman Building, Columbus, O., by July 30, for furnishing of the material and the performance of the labor necessary for the erection and completion of the Power Building, including the wiring and heating, for the above mentioned institution, as per plans and specifications, which are on file at the offices of Mills, Rhines, Bellman & Nordhoff, Toledo, O.; at the Builder's Exchange, Columbus; and the office of the Auditor of State.

ELECTRIC APPLIANCES—Sealed proposals will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until July 29 for furnishing one 30-kilowatt motor generator, as per Schedule 5,637, and 15 five-kilowatt radio sets for ship installation, as per Schedule 5,625; both for delivery at the Navy Yard, Brooklyn, N. Y.; and until August 5 for furnishing six motor-driven engine lathes, as per Schedule 5,623 for delivery at the Navy Yard, Puget Sound, Wash.; 15 transmitting and receiving radio sets, as per Schedule 5,639 for delivery at the Navy Yard, Washington, D. C. The Bureau will also receive proposals until August 5 for rewiring the quarters at the Navy Yard, Norfolk, Va., as per Schedule 5,641.

NEW INCORPORATIONS.

JOHNSTOWN, PA.—A state charter has been issued to the Jenner Township Public Service Company, with a capital of $5,000. N.

MANNINGTON, KY.—The Right-Light Company has been incorporated with a capital stock of $10,000 by A. F. Millan, T. V. Morgan, and others, to manufacture and sell light and heat appliances.

AVON, N. Y.—Temple Electric Construction Company, Incorporated, has been granted a charter with a capital stock of $2,500. The incorporators are M. D. Gould, L. P. Tabor and D. M. Lewis, all of this city.

LOS ANGELES, CAL.—The California Automobile Company has been formed in this city, its purpose being to manufacture exclusively the Beardsley electric automobile. John T. Shannon is electrical engineer of the company. T.

NEW YORK, N. Y.—J. Menkes Electric Company, Incorporated, has been granted articles of incorporation with a capitalization of $1,000. The incorporators are Jack Menkes and Moses Strassman, New York City; and Gabriel Soffer, Brooklyn, N. Y.

CHARLESTON, W. VA.—Modern Electric & Plumbing Company has been incorporated with a capital stock of $5,000 for the purpose of engaging in a general plumbing and electrical business. The incorporators are W. G. Mathews, Jacob Friedman, John R. Koch, A. P. Hudson and L. P. Williams, of Charleston.

FINANCIAL NOTES.

The Southern Utilities Company has sold to a syndicate of New York bankers $260,000 one-year, six-per-cent gold notes dated July 1, 1913. This is part of an authorized issue of $500,000 which are secured by $750,000 first-mortgage five-per-cent, 20-year gold bonds of the company.

The Westinghouse Electric & Manufacturing Company has sold to Kuhn, Loeb & Co. $3,250,000 six-per-cent, two-year notes to provide for the retirement of the existing issue of $4,000,000 notes which will mature on August 1 next. The remaining $750,000 will be paid out of the treasury of the company. The new notes will mature on August 1, 1915.

The Louisville Gas & Electric Company has acquired the Kentucky Electric Company delivering in payment therefrom a single check for $2,000,000 payable to the Kentucky Electric Company, out of which the stockholders of the latter company will be paid for their holdings. Plans are being made to retire at once at par and five-per-cent interest an issue of $100,000 of Kentucky Heating Company bonds issued in 1895 and due in 1915, held almost entirely by the Fidelity & Columbia Trust Co. of Louisville. A $200,000 issue of bonds of the Louisville Gas Company is to be retired very soon and later a $100,000 bond issue of the Kentucky Electric Company. The Louisville Gas & Electric Company has filed a mortgage in the county clerk's office to secure a bond issue of $15,000,000, which will be pledged to the Harris Trust & Savings Bank of Chicago for a loan of that amount. The bond issue will be for five years and bear six-per-cent interest. Three thousand of the bonds will be of $500 denomination and $13,500 will be in $1,000 denomination. The mortgage is on 110 pieces of real estate now owned by the Louisville Gas & Electric Company in Louisville.

A plan has been perfected for the consolidation of the Manchester (N. H.) Traction, Light & Power Company with the Nashau (N. H.) Light, Heat & Power Company.

The former has $2,800,000 stock capitalization and $2,000,000 bonds. The Nashau Company has $600,000 stock and no bonded debt. The plan, which has already been approved by directors of the Nashau Company, involves exchange of one share of stock in that company for one share of full-paid stock in Manchester Traction and $40 in cash, provided that holders of at least 90 per cent of the stock of the Nashau Company agree to the exchange. The Manchester Company, which generates substantially all of its electric current at its several water power developments, has a present surplus of hydroelectric power more than sufficient to operate the Nashau plant, and in addition owns undeveloped water power sufficient to meet probable necessities of both cities for many years to come. It is controlled by Tucker, Anthony & Company, of Boston.

An amendment to the charter of the Chesapeake & Potomac Telephone Company of Baltimore city has been filed in the record office, increasing the capitalization of the company from $10,000 to $10,000,000. The increased capitalization was authorized by stockholders of the company at a meeting held February 13 last. Application will shortly be made to the Public Service Commission for permission to issue the new stock. As the present capitalization of $10,000 of the company has already been issued as common stock and paid for in cash, the additional capital authorized is $9,990,000, which will be divided into 198,800 shares, with a par value of $50. The document was signed by F. H. Bethell, president of the company; Charles H. Carter, Thomas J. Shryock, W. N. Bethell and M. H. Buehler. The issuance of the stock will mark the financial independence of the company from the Chesapeake & Potomac Telephone Company of New York. The company was originally a part of the New York corporation, but was later made an independent corporation under the laws of Maryland, with a capital of $10,000.

A $5,000,000 mortgage, one of the largest ever filed in the country was recorded at Eaton, Ohio, recently, and was given by the Ohio Electric Railway Company to the Fidelity Trust Company, of Philadelphia. The mortgage covers bonds that the Trust Company is floating for the traction company and the real and personal property owned by the Ohio Electric Company, in 28 counties. The money will be used in needed improvements on the road and for the retirement of other bonds. The company recently reduced their capital stock from $25,000,000 to $14,000,000.

Dividends.

Columbia Railway; a regular quarterly dividend of 1.25 per cent on the preferred stock, payable August 1.

Commonwealth Gas & Electric Company; a quarterly preferred dividend of $1.25 per share, and a common dividend of 50 cents per share, payable July 15.

Electric Bond & Share Company; regular quarterly dividends of 1.5 per cent on preferred, payable August 1 to stock of record July 19, and two per cent on common, payable July 15.

Electric Company of America; 30 cents a share, payable August 1.

East St. Louis Suburban Company; regular quarterly dividend of 1.25 per cent on preferred, payable August 1.

Jacksonville Traction Company; regular quarterly dividend of $1.50 on preferred and $1.75 on common, payable August 1.

Lowell Electric Light Corporation; regular quarterly dividend of $2, payable August 1.

Milwaukee Electric Railway & Light Company; regular quarterly dividend of 1.5 per cent, payable July 31.

New Hampshire Electric Railway Company; a semi-annual preferred dividend of two per cent, payable July 31.

Sierra Pacific Electric Company; a regular quarterly dividend of $1.50 on preferred stock, payable August 1.

Southern Utilities Company; regular quarterly of 1.75 per cent on preferred, payable August 1.

United Traction of Pittsburgh; the regular semi-annual dividend of 2.5 per cent on the preferred stock, payable July 19.

West Penn Railways Company, the regular quarterly dividend of 1.25 per cent on the preferred stock, payable August 1.

Earnings of Public Utilities.

PORTLAND RAILWAY, LIGHT POWER.

Portland Railway, Light & Power Company reports earnings for May, 1913, and for twelve months ended May 31, 1913, as follows:

	1913	1912
Gross	$ 549,852	$ 543,813
Net after taxes	280,143	278,907
Surplus after charges	117,969	130,515
Twelve months gross.	6,697,304	6,446,311
Net after taxes	3,401,166	3,248,723
Surplus after charges	1,571,879	1,629,975

Surplus after charges, for twelve months, is equivalent to 6.3 per cent on the outstanding capital stock.

UNITED LIGHT & RAILWAYS.

The United Light & Railways Company reports consolidated earnings of its subsidiary properties for May, 1913, and the 11 months ended May 31, 1913, as follows:

	1913	1912
May gross	$ 479,857	$ 409,967
Net after taxes	185,590	157,148
Surplus after charges	72,404	64,492
Eleven months gross.	5,221,753	4,630,009
Net after taxes	2,177,589	1,867,553
Surplus after charges	1,082,183	850,117

AMERICAN PUBLIC UTILITIES.

The American Public Utilities Company, reports consolidated earnings of subsidiary corporations for May, 1913 and the eight months ended May 31, 1913, as follows:

	1913	1912
May gross	$ 166,933	$ 137,896
Net after taxes	70,263	50,210
Eight months gross	1,569,486	1,376,857
Net after taxes	720,136	615,767

REPUBLIC RAILWAY & LIGHT.

	1913	1912
April Gross	$ 229,716	$ 205,309
Net after taxes	84,478	79,830
Surplus after charges.	38,595	35,605
Twelve months gross.	2,773,287	2,485,043
Net after taxes	1,095,147	991,797
Surplus after charges.	559,772	459,613

LAKE SHORE ELECTRIC.

	1913	1912
May Gross	$ 116,371	$ 107,140
Net after taxes	44,027	43,587
Surplus after charges.	8,947	8,897
Five months gross	498,932	446,336
Net after taxes	168,570	172,099
Deficit after charges	6,401	1,637

*Surplus.

KEYSTONE TELEPHONE.

	1913	1912
June gross	$ 105,599	$ 101,111
Net after taxes	54,056	50,144
Surplus after charges.	28,547	24,787
Six months gross	626,172	597,191
Net after taxes	309,473	298,495
Surplus after charges.	157,976	148,253

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	July 14.	July 7.
American Tel. & Tel. (New York)	126¾	129¼
Commonwealth Edison (Chicago)	*128	128
Edison Electric Illuminating (Boston)	275	270
Electric Storage Battery common (Philadelphia)	45	45½
Electric Storage Battery preferred (Philadelphia)	45	45½
General Electric (New York)	138	137
Kings County Electric (New York)	129	129
Manhattan Transit (New York)	1⅝	1¾
Massachusetts Electric common (Boston)	13½	13
Massachusetts Electric preferred stamped (Boston)	69½	67
National Carbon common (Chicago)	*113	*113
National Carbon preferred (Chicago)	*111	*111
New England Telephone (Boston)	139⅞	138½
Philadelphia Electric (Philadelphia)	21¾	21⅝
Postal Telegraph and Cables common (New York)	76	76
Postal Telegraph and Cables preferred (New York)	65	64½
Western Union (New York)	61	60½
Westinghouse common (New York)	56	59
Westinghouse preferred (New York)	104	106

*Last price quoted.

PERSONAL MENTION.

THURSTON OWENS, vice-president and general manager of the La Crosse Gas & Electric Company, La Crosse, Wis., has been elected general secretary-treasurer of the "Gas Meeters."

THEODORE P. SHONTS, president of the Interborough Rapid Transit Company and the New York Railways Company, sailed for Europe on July 9, to be abroad until about the first of September.

GEORGE W. CONOVER, a graduate of the University of Pennsylvania, and formerly connected with the Philadelphia Electric Company, Philadelphia, Pa., has been appointed advertising manager of the F. Bissell Company, Toledo, O.

W. A. WARREN has recently been appointed city electrician in Asheville, N. C., to succeed R. B. Hampton, resigned. Mr. Warren is one of the very popular young electricians of the city. He has been engaged in electrical work in Asheville for seven years.

ZENAS W. CARTER, secretary of the Electric Development Association, Boston, Mass., and Mrs. Carter sailed for Europe on July 13 on the *Ionian*, of the Allan Line, Montreal. They expect to spend about two months in England, France, Belgium and Scotland.

ROBERT E. HUGHES, who recently retired as president of the Kentucky Electric Company, Louisville, Ky., after a service covering more than six years and including the entire career of the company, will make a trip to the Orient of about three months' duration. He will be accompanied by his family.

John D. NOYES has recently joined the sales department of the Detroit Edison Company, and will specialize in the industrial department on motor applications. Mr. Noyes was for a number of years connected with the Detroit office of the Westinghouse Electric & Manufacturing Company, and acquired a wide acquaintance in the electrical business.

HARVEY R. WORTHINGTON, of Jacksonville, Fla., whose name was mentioned in connection with a report of the meeting of Southern Jobbers at Memphis several weeks ago as being connected with the H. R. Worthington Company, is with the Florida Electric Company, his connection as above indicated having been stated unintentionally by mistake.

LEON S. DURE, of Macon, Ga., has been elected vice-president of the Union Railway & Light Company, the Central Georgia Power Company, the Georgia Transmission Company and the Macon Gas Company, the Leach Company's properties in Macon, succeeding T. F. WICKHAM, who will now be identified with the Leach interests in Cincinnati.

HENRY L. ANGLACH has been appointed superintendent of the Bureau of Electricity, of Pittsburgh, Pa., by Director John H. Dailey, of the Department of Public Safety, to fill the vacancy caused by the death of ROBERT J. DALEY. Mr. Anglach had been assistant to Mr. Daley for nine years, and has been in the Bureau since 1884. JAMES A. GORMAN, another Bureau employee, was named to fill the place left vacant by the promotion of Mr. Anglach.

H. F. THOMSON, assistant and Secretary of the Division of Electrical Engineering Research of Massachusetts Institute of Technology, is a native of Cincinnati. He came to Massachusetts Institute of Technology in 1910 and has been research assistant and research associate in the Department of Electrical Engineering. His work has been largely along the line of vehicle investigation and he is author of articles on storage batteries, the operation of delivery services, electric vehicles, and of the Bulletins issued from the Institute on vehicle research. He is one of the associate editors of the American Electrical Engineers' Handbook.

HAROLD PENDER has been made director of the Division of Electrical Engineering Research at Massachusetts Institute of Technology, Boston. Dr. Pender is a native of North Carolina and is 34 years of age. He graduated from Johns Hopkins in 1808 and was an assistant in the Physical Laboratory, later being instructor at McDonagh School, Maryland, and at Syracuse University. In 1903 he visited Paris and there repeated experiments he had made in America, on the magnetic effect of a moving electrostatic charge, proving that it does produce a magnetic field. After service with the Westinghouse Company and the New York, New Haven & Hartford Railroad, and work in the employ of Cary T. Hutchinson, Dr. Pender came to the Massachusetts Institute where he held the professorship of theoretical and applied electricity, last year becoming professor of electrical engineering. He is author of a book on "Principles of Electrical Engineering" and editor of "The American Electrical Engineers' Handbook."

OBITUARY.

THOMAS H. FABEN, for many years an employee of the Toledo Railways & Light Company, Toledo, O., and a son of the first superintendent of the Toledo Gas Light Company, died suddenly at his home in Toledo, on July 12, aged 54 years.

BURTON E. BAKER, inventor of an X-ray tube, died last week at his home in Hartford, Conn., literally the victim of his own genius. The inventor's last illness was due to exposure to X-rays, the disease manifesting itself in burns and a cancerous growth which spread throughout his entire system.

NEW PUBLICATIONS.

INVENTION OF THE DYNAMO.—We have received a reprint from the *Bulletin Mensuel de la Société Belge d'Électriciens* entitled "L'Invention de la Dynamo," by Émile Pierard.

ELECTRIC WELDING.—The New York Public Library has published a pamphlet containing a list of works relating to electric welding. This list was compiled by William B. Gamble. Literature up to the middle of 1912 is covered.

CONDIT PLANT.—The Condit Plant of the Northwestern Electric Company upon the White Salmon River, Ore., is described in a booklet which has been issued by the Stone & Webster Engineering Corporation, which did the construction work. This development is one of 20,000 horsepower and required about ten months to build, the first unit being operated in March of this year. The booklet describes the various points of interest in the project and gives some excellent illustrations.

FOREIGN TRADE OPPORTUNITIES.

(*Parties interested in the following items should address the Bureau of Foreign and Domestic Commerce, Washington, D. C., and refer to the file number noted.*)

NO. 11,261. TELEGRAPH AND TELEPHONE LINES.—The American consul general at Athens, Greece, reports that a royal decree has been issued authorizing the expenditure of 1,550,000 drachmas ($299,150) for the construction and equipment of new telegraph and telephone lines within the Kingdom and the newly acquired territories. Further information may be obtained from the Ministry of Interior, Athens. It is advisable that correspondence be in French.

NO. 11,283. ELECTRIC RAILWAY CONSTRUCTION WORK.—An American consular officer in the Far East transmitted the names of two electric-light companies in his district which are preparing to construct electric railway lines about 20 miles in length. Correspondence may be in English.

NO. 11,267. CHAIN-MAKING MACHINERY.—A merchant in a European country informs an American consul that he desires to purchase machines for making chains, also apparatus for welding by electricity. Correspondence may be in English.

DATES AHEAD:

California State Association of Electrical Contractors. Fourth annual convention, Santa Barbara, Cal., August 13-16.

Michigan Section, National Electric Light Association. Annual convention, Ottawa Beach, Mich., August 19-21.

International Association of Municipal Electricians. Annual meeting, Watertown, N. Y., August 19-22.

Old-Time Telegraphers and Historical Association and Society of the United States Military Telegraph Corps. Annual reunion, Detroit, Mich., August 26-28.

Association of Edison Illuminating Companies. Annual convention, Cooperstown, N. Y., September 8-11.

American Electrochemical Society. Semi-annual meeting, Denver, Colo., September 9-11.

American Institute of Electrical Engineers. Pacific Coast Convention, Vancouver, B. C., September 9-11.

Northwest Electric Light and Power Association. Annual convention, Seattle, Wash., September 10-12.

Pennsylvania Section, National Electric Light Association. Annual convention, Deleware Water Gap, Pa., September 16-18.

New England Section of the National Electric Light Association. Annual convention, Hotel Vermont, Burlington, Vt., September 17-19.

Illuminating Engineering Society. Annual convention, Pittsburgh, Pa., September 22-26.

Colorado Electrical and Industrial Exposition, Auditorium, Denver, Colo., October 4-11.

Colorado Electric Light, Power & Railway Association. Eleventh annual convention, Denver, Colo., October 6.

Electrical Exposition and Motor Show of 1913. New Grand Central Palace, New York, N. Y., October 15-25.

Telephone Pioneers of America. Annual meeting, Chicago, Ill., October 16-17.

With the Electrical Manufacturers

Chicago Mica Company, Valparaiso, Ind., has added to its list of Micabond products the following: Champion insulating paint and Crystal varnishes, fish paper, cotton tape, webbing, and sleeving. The company expects to develop considerable trade in these new products, particularly in the paint and varnish line, which is one of the products which it used to carry in stock some years ago.

Independent Lamp & Wire Company, Incorporated, New York, has ready for distribution a catalog replete with information pertaining to insulated wires for electrical purposes. In the preparation of this booklet the company has attempted to acquaint the electrical industry with its asbestos-insulated wire products and also to furnish data which will be of value for reference. Copies of this booklet will be furnished to those interested upon request.

King Foundry Company, St. Joseph, Mo., announces a big demand and sale for the King ornamental lighting standards. Orders have recently been received for furnishing posts for the following communities: Henry, Ill.; Hinsdale, Ill.; Oak Park, Ill.; and Maywood, Ill. The company is now working on an order for posts for the city of Chicago, which is one of the largest that has been placed in recent months. This order is for the new official King-Chicago posts, the type which has been approved by the city of Chicago. Five hundred of these posts are on order from the Commonwealth Edison Company.

General Electric Company, Schenectady, N. Y., has added a number of new bulletins to its numerous publications. Most of bulletin No. A4123 is devoted to automatic voltage regulators for the regulation of alternating-current generators by means of control of the exciter field; another section of this bulletin is devoted to a similar type of regulator for direct-current generators; a third section of the bulletin describes high-voltage cut-out relays suitable for use in connection with the foregoing regulators.—Bulletin A4129 describes feeder-voltage regulators of the pole type for use on single-phase feeders. These regulators are made in two designs, one for outdoor installation, which is automatically operated, and the other for indoor use and manual operation.—Bulletin A4121 is devoted to type CVC direct-current motors with commutating-pole construction. These machines are rated in sizes from two to 20 horsepower.—Bulletin A4127 describes the company's combined straight and automatic air-brake equipment for use on either single cars or on trains of three or more cars. These equipments are particularly designed for interurban electric-railway service in which both single cars and trains are run.

Kerr Turbine Company, Wellsville, N. Y., reports the largest volume of business in its history. Recent shipments of its Economy turbines are as follows: Four 800-horsepower turbines for driving 25,000,000-gallon pumps, Chicago Water Works; an 850-horsepower turbine for similar service at Nashville, Tenn.; two 100 and two 150-kilowatt turbogenerator sets for Republic Coal Company, Roundup, Mont.; two 35-kilowatt generator sets for the steamship *Washington Irving;* three 75-kilowatt sets for the new steamship *Seeandbee* for Great Lakes service; four turbopump units for Swift & Company; two for Detroit General Hospital; two for Pittsburgh Crucible Steel Company; two for Carnegie Steel Company. Recent export orders have also been received from England, Sandwich Islands and India. Also 16 turbines have just been ordered by one of the largest pump builders in the country. The company has just developed its first 500-kilowatt alternating-current unit and is now better prepared than ever before to serve its customers with larger electrical units. There are now being built in the shops, 72 turbines aggregating some 10,000 horsepower. Over 100,000 horsepower of this company's product is now in daily service.

Record of Electrical Patents.

Issued by the United States Patent Office, July 8, 1913.

1,066,460. Lamp. W. F. Anklam, assignor to C. M. Hall Lamp Co., Detroit, Mich. An automobile headlight with socket between the parabolic reflector and casing.

1,066,468. Process and Apparatus for Electric Welding. L. W. Chubb, assignor to Westinghouse Electric & Mfg. Co. Consists in effecting percussion of the surfaces and producing an electric welding heat thereat.

1,066,475. Electric-Lamp Cutout. S. Dunning, assignor to Westinghouse Lamp Co. An insulating film between the lamp stem and screw base.

1,066,476. Lightning Arrester. W. H. Elliott, Albany, N. Y., assignor to Hall Signal Co. Comprises an electrically selective discharge block and a number of selective plates forming spark gaps with the central block.

1,066,479. Alarm Attachment for Refrigerator Drip-Pans. J. Fiala, Omaha, Nebr. Includes a battery, a circuit-closer and an alarm.

1,066,484. Ozone Generator. W. O. Freet, Hackensack, N. J., assignor to Steynis Ozone Co. A number of ring-shaped electrodes are spaced apart.

1,066,493. Illuminated Advertising Device. H. Harrold, Chicago, Ill. Surrounding an incandescent lamp is a rotating shell whose cylindrical surface is transluscent and whose top consists of impellers.

1,066,494. Dynamo-Electric Machine. E. Held, Stuttgart, Germany. Has a split-pole bipolar field, a bipolar T armature and magnetic-flux conductors carried by the armature midway between its poles and magnetically insulated therefrom.

1,066,504. Electrode-Lead for Vapor Electric Apparatus. C. A. Kraus, Newton Highlands and R. D. Mailey, Lynn, Mass. A screen about the anode confines the arc between it and the mercury cathode.

1,066,505. Anode-Shield for Vapor Electric Apparatus. C. A. Kraus and R. D. Mailey. A box inclosing the anode has partitions with nonregistering openings turned toward the cathode.

1,066,507. System of Control for Electric Motors. B. G. Lamme, assignor to Westinghouse Electric & Mfg. Co. Auto-starter with different voltage taps has the induction motor permanently connected to the inner taps and has means for successively shifting the supply connections to the taps and finally connecting them to the points where the motor is connected.

1,066,513. Electrical Regulation for Electric Motors. B. McInnerney, Council Bluffs, Iowa. Provides solenoid switches for the rotor resistances of an induction hoisting motor.

1,066,538. Automatic Railway Signal and Stop. A. T. Smith, Sioux City, Iowa. An automatic closed-circuit signal system with a trip operated by the engine or car.

1,066,540. Combined Club and Flashlight. G. A. Smithwick, Metaline Falls, Wash. The hollow handle of a policeman's club contains a dry cell, lamp, lens, and switch.

1,066,554. System of Electrical Distribution. H. G. Thompson, Glen Ridge, N. J., assignor to Safety Car Heating & Lighting Co. A car-lighting system with generator, storage battery and combined regulator for the battery and lighting circuits.

1,066,570. Apparatus for the Purification of Water and Other Liquids. M. D. Avery, Kansas City, Mo. An electrolytic cell with alternate anode and cathode plates on a rotatable vertical post.

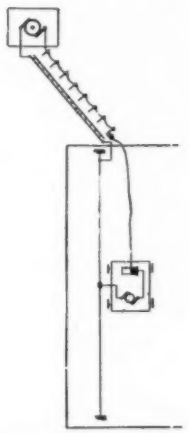
1,066,580. Speed-Regulator for Electric Motors. L. Bradley, Milwaukee, Wis. Includes compressible resistance units which are cut out of the armature circuit and into the field circuit.

1,066,582. Electric Motor. J. Buckley, assignor to Viscol Co., Cambridge, Mass. The armature has disk-like ends subdivided into segmental sections forming armature poles.

1,066,591. Interchangeable-Letter Electric Sign. J. W. Ellis, assignor to Ellis National Electric Sign Co., Denver, Colo. The framework consists of units connected alongside each other and each carrying two busbars for a high-tension supply and two bars forming the secondary connections of a transformer mounted on one unit.

1,066,616. Motor-Controller. A. J. Horton, assignor to Cutler-Hammer Mfg. Co., Milwaukee, Wis. A combined motor-starting and field-regulating rheostat in which both arms move together in starting and then the field arm moves independently.

1,066,619. Polyphase Magnetic Separator. H. L. Isbell, assignor to American Brass Co., Waterbury, Conn. The core has polyphase windings arranged to produce a longitudinally moving magnetic field.



1,066,774.—Electric Supply for Agricultural Machines.

1,066,635. Electric Motor and Pump. W. R. Macdonald, London, England. Has a pump impeller intermediate the length of the rotor.

1,066,648. Electrically Driven Portable Machine. A. Palmros, assignor to Pneumelectric Machine Co., Syracuse, N. Y. Includes a reel upon which the supply conductors are wound, a rheostat, and a machine operated by a motor.

1,066,651. Electrode for Secondary Galvanic Cells. H. P. R. L. Pörscke and J. A. E. Achenbach, Hamburg, Germany. An alkaline-battery electrode consists of poorly conductive active material in which is imbedded a conductive grid of thin perforated metal, the whole being tightly rolled to form a cylinder.

1,066,653. Press. E. Rau, New York, N. Y. An electrically heated chase.

1,066,656. Electric Scale. H. Richardson, Passaic, N. J. A weighing machine with an electromagnetically controlled feed device.

1,066,674. Apparatus and Method for the Production of Ozone. J. Steynis, New York, N. Y., assignor to Steynis Ozone Co. Includes hollow electrodes and means for cooling the ozonized air.

1,066,676. Means for Winding Electromagnets. A. Sundh, assignor to Otis Elevator Co., Jersey City, N. J. A combined rheostat and reversing switch for controlling the starting, braking, stopping, speed and reversal of the motor driving the machine.

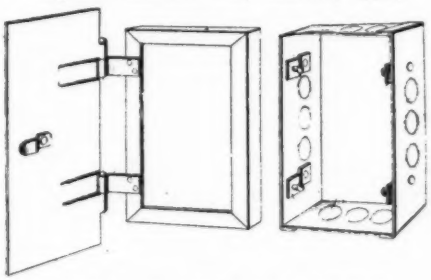
1,066,677. Electromagnet Switch. A. Sundh, assignor to Otis Elevator Co. The movable core of the magnet operates the switch through a link, spring and a buffer.

1,066,678. Car-Switch Controller for Electric Elevators. A. Sundh, assignor to Otis Elevator Co. A reversing controller in the car governs electromagnetic motor switches.

1,066,681. Electric Cab Signaling System. J. W. Tatum, assignor of one-sixth each to B. N. Duke and W. Fuller, New York, N. Y., to E. J. Parrish, J. W. Smith and R. B. Boone, Durham, N. C. For telephonic communication with the locomotive engineman.

1,066,682. Electric Welding Machine. A. C. Taylor, assignor to National Electric Welder Co., Warren, O. A spot-welding machine with swiveled electrodes rocking in supporting arms.

1,066,706. Outlet-Box Bracket. J. C. Caine, assignor of one-half to New England Electric Co., Denver, Colo. Has end-securing portions provided with plaster holds and an intermediate offset forming a seat closely fitting the sides of the box.



1,066,805.—Adjustable Cabinet-Box Rim.

1,066,721. Antireverser for Alternating-Current Circuits. E. L. Gale, Sr., assignor to Otis Elevator Co. An automatic reversing switch prevents reversal of an elevator motor when one of the phases is reversed.

1,066,726. Welding Machine. J. H. Gravell, assignor to Hale & Kilburn Co., Philadelphia, Pa. A work-supporting member is adjustably mounted on the terminal and electrically connected thereto.

1,066,729. Magneto. E. S. Huff, assignor to H. Ford, Detroit, Mich. A flywheel magneto with multipolar field consisting of a permanently magnetized steel disk made of superposed laminas radially divided.

1,066,731. Thermostatic Alarm. F. Jaynes, Des Moines, Iowa. A heat-controlled electric alarm.

1,066,739. Alternating-Current-Motor Control. D. Larson, assignor to Otis Elevator Co. The rotatable part of the controller is geared to the motor so as to make a complete rotation during the initial movement of the rotor.

1,066,741. System of Motor Control. D. L. Lindquist, assignor to Otis Elevator Co. A compound elevator motor has an accelerating magnet to short-circuit the starting resistance, a switch operated thereby to close circuit through a relay and a switch operated by the relay to shunt the starting resistance and series field.

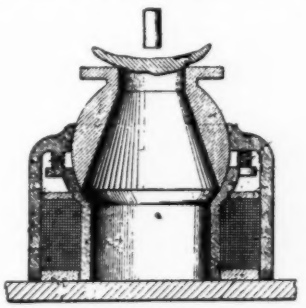
1,066,742. Electromagnetic Brake. W. D. Lutz, assignor to Otis Elevator Co. Has special means for controlling the flux so as to produce slow application of a brake.

1,066,747. Potential Regulator. P. Muller, assignor to General Electric Co. Comprises two inductively related windings electrically at an angle to each other, also a short-circuited winding and a working winding at the same angle.

1,066,748. Train Signal. A. R. Mutton, Waterloo, Iowa, assignor of one-half to O. P. Higdon. An electric signal system with sectionalized track rails.

1,066,773. Signal-Base for Baseball Fields. S. H. Wills, Le Grand, Cal. Stepping on the upper hinged part of the base plate closes an electric indicating circuit.

1,066,774. Means for Electrically Driving Motor Agricultural Machines. W. Wortmann, Mainz, Germany. An armored cable connected to the supply can be reeled or unreeled on the machine; the return circuit is through a bare wire lying on the ground. (See cut).



1,066,951.—Universal Electromagnetic Chuck.

1,066,783. Electric Switch. F. Barr, New York, N. Y. A rotary snap switch with inner and outer sets of inclined contact surfaces.

1,066,786. Locking Device for Telephones. C. C. Bielitz, Brooklyn, N. Y. Locks the switch-hook to the upright of a desk stand.

1,066,789. Lace Machine. J. H. Bromley, Jr., Philadelphia, Pa. Means operated by jacquard cards open and close electric circuits that control the operation of the threads.

1,066,805. Adjustable Iron Cabinet Box for Electric-Light-Wiring Cutouts. J. C. Fisher, assignor of one-half to New England Electric Co., Denver, Colo. Has a rim with introverted flange adapted to fit within the open end of the box and be clamped between the sides of the box and a set of locking plates. (See cut).

1,066,810. Thermal Treatment of Metal in Electrically Heated Furnaces. P. Girod, Ugines, France. Consists in effecting complete solidification of the melted steel, further cooling to below 1,100 degrees centigrade and then remelting by electrically generated heat.

1,066,816. Jointed Rod for Inserting Wires in Conduits and Analogous Purposes. J. J. Hess, Chicago, Ill. The

rods are connected through pintles and torsion springs, whose ends are concealed in adjoining rods.

1,066,823. Electrical Distribution. R. C. Leake, Baldwinsville, N. Y. An electric selective system with means at the sending station for actuating a coherer at the receiving station so as to connect a relay to the line and thereby control the selector.

1,066,831. Alternating-Current Motor. A. S. McAllister, New York, N. Y. A single-phase commutator motor with a commutating-flux core and coil and means, including a reactance in circuit with the coil, for subjecting the core to a magnetomotive force proportional to the voltage between the brushes.

1,066,836. Lamp-Shade Holder. F. J. Nahuis, assignor to Empire Brass Mfg. Co., Cleveland, O. Comprises an annular web adapted to pass over the socket bead and provided with an inner edge and flange having a cylindrical portion with annular groove to engage the bead.

1,066,847. Lighting Attachment for Gas-Burners. J. K. Rush, Syracuse, N. Y. An electric igniter.

1,066,855. Process of Extracting Metals from their Ores. H. B. Slater, Riverside, Cal., assignor of one-half to R. B. Shelden. A process for electrolytic treatment of metallic chlorides.

1,066,856. Theft-Detector for Electric Meters. J. T. Sloan and A. G. English, Wichita, Kans. A differential electromagnet establishes a shunt across the mains when more current passes one side of the meter than on the other.

1,066,893. Winding for Dynamo-Electric Machines. C. J. Fechheimer, assignor to Allis-Chalmers Co. and Bullock Electric Mfg. Co. A two-layer winding comprising formed coils with each coil forming the upper layer in one slot and the lower layer in another slot.

1,066,904. Electric Ignition System for Internal-Combustion Motors. G. Honold and O. Heins, assignors to firm of Robert Bosch, Stuttgart, Germany. Includes a magneto and storage battery with a commutator between them to permit charging the battery.

1,066,910. Train Signaling Device. E. M. Jones, assignor to Jones Signal System Co., Atlanta, Ga. A ramp along the track is adapted to close the signal circuit.

1,066,912. Fuse. J. Keefe, assignor to J. H. Parker, Cliftondale, Mass. Includes special means for holding together the two parts of an Edison porcelain plug fuse.

1,066,929. Electric Bell or Alarm. A. Längen, assignor to Edwards & Co., New York, N. Y. Relates to details of the armature construction.

1,066,951. Work Support or Holder. L. D. Rowell, assignor to Cutler-Hammer Clutch Co., Milwaukee, Wis. A magnet winding is placed about a spherical socket adapted to act as a chuck and containing an adjustable ball with hollow conical core. (See cut).

1,066,961. Automatic Cutout for Clock-Synchronizing Mechanism. E. A. Hummel, assignor to A. L. Haman, St. Paul, Minn. Has means for automatically breaking the circuit directly after the synchronizing blow has been struck.

1,066,963 and 1,066,964. Case for Incandescent-Electric-Lamp Sockets. A. Weber, Sr., and J. Weber, assignors to Weber Electric Co., Schenectady, N. Y. Relate to the interlocking of the cap and shell.

1,066,965. Circuit-Controlling Device. F. J. West and H. W. Darby, Winnipeg, Man., Canada. A mercury well with rotating shaft and contact-making plates.

1,066,979. Spark Plug. F. T. H. Bacon, New York, N. Y. Covers details.

1,067,003. Process of Making Electrical Conductors. W. Deats and C. Scott, assignors to National Carbon Co., Cleveland, O. Brushes made by mixing together finely pulverized carbon and metallic copper, subjecting the mixture to high pressure to form a block and baking the block.

1,067,005. Connection for Lamps or Other Electric Apparatus. A. Dénéréaz, assignor to Société Anonyme pour l'Exploitation des Brévets A. Dénéréaz, Montreux, Switzerland. Porcelain connecting socket with contact springs into which a corresponding plug can be pushed.

1,067,024. Interchangeable Electric Sign and Lamp Therefor. F. P. Hall and J. O. Sharpe, Newark, N. J. Includes two parallel wire screens connected to opposite sides of the circuit and between which the lamp connections are made.

1,067,031. Electrode for Use in Electrothermal Processes. E. B. Jewett, assignor to National Carbon Co. Consists of carbon flour agglomerated by a carbonaceous coke and relatively large particles of carbonaceous material.

1,967,047. Machine for Producing and Transcribing Perforated Symbols. E. M. v. Marchthal, assignor to Siemens & Halske A. G., Berlin, Germany. Key-controlled switches govern the punches.

1,067,112. Delivery Apparatus. P. Hempel, Parkston, S. D. An electric telpherage system for rural districts with trolleys running over the fences along the highway.

1,067,161. Machine for Manufacturing Flexible Electric Conduits. C. O. Berg, Chelsea, Mass. Includes a mandrel for winding and sewing sheet material to form helical duct.

1,067,179. Wireless Telephony. V. H. Laughter, Detroit, Mich., assignor to North American Wireless Corporation. The sending station has connected across the energizing circuit a condenser with fixed and vibratory plates.

1,067,191. Dynamo-Electric Machine. N. Pensabene, Birmingham, England. A field-magnet system comprising groups of poles of like polarity, means producing between the poles a leakage flux, and a movable iron core between two adjacent projections of the same group of poles for regulating the leakage flux.

1,067,194. Wiring for Electric Call-Bell Circuits. G. A. Pierce, Philadelphia, Pa. Provides for interconnection between several annunciator stations with a minimum of wiring.

1,067,207. Sound Screen. R. L. Williams, assignor to Submarine Signal Co., Waterville, Me. Adjoining microphones submerged in a water tank in the hull of a vessel are screens with gas compartments.

1,067,217. Electric Controlling Apparatus. W. H. Gaulke, assignor to Independent Electric Mfg. Co., Milwaukee, Wis. A two-position polyphase-motor-starting switch that is held in running position by an electromagnet.

1,067,228. Apparatus for Governing the Passage of Cars or Vehicles along a Railway and the Control Thereof. L. A. Hawkins, assignor to Union Switch & Signal Co. Includes a polyphase motor with one part of the rotor winding intermittently connected to an indicator.

Reissues.

13,591. Rotor Windings for Alternating-Current Dynamo-Electric Machines. L. J. Hunt, assignor to General Electric Co. Original No. 1,057,061, dated Mar. 25, 1913. Provides two numbers of poles for cascade connection of induction motors.

13,594. Alarm Lock. M. Sheinman, assignor to Automatic Alarm Lock Co., New York, N. Y. Original No. 994,542, dated June 6, 1911. An electrical alarm is actuated on unlocking of the bolt.

Patents That Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office that expired July 14, 1913:

563,723. Coating Metals by Electrolysis. H. Alexander, Berlin, Germany.

563,724. Annunciator System for Buildings. J. M. Arthur, Detroit, Mich.

563,725. Brake for Electric Cars. W. V. Ash, Irvington, N. J.

563,743. Circuit-Controlling Device. J. H. Clark, Boston, Mass.

563,749. Trolley Wheel. W. C. Cottrell, Asbury Park, N. J.

563,773. Electric Arc Lamp. J. C. Knight, Roselle, N. J.

563,780. Electric Heater. C. H. Minchew, Taunton, Mass.

563,832. Automatic Fire-Alarm System. J. Young, Chicago, Ill.

563,877. Telephone System. W. R. Patterson, Chicago, Ill.

563,883. Electrical Program Clock. A. J. Reams, Chicago, Ill.

563,895. Rotary Transformer. E. Thomson, Swampscott, Mass.

563,911. Dynamo-Electric Machine. W. Cooper, Schenectady, N. Y.

563,917. Instrument for Measurement of Electric Resistances. S. Evershed, London, England.

563,920. Telephone System. A. Graham, London, England.

563,922. Electric-Lamp Stand. W. D. Gridley, Brooklyn, N. Y.

563,924. Railway Signal. C. Hansel, Easton, Pa.

563,934. Aero-Electric Automatic Brake. C. Luyers, Brussels, Belgium.

563,935. Telephone Transmitter. H. A. Martin, Hartford, Conn.

563,940. Dynamo-Electric Machine. A. L. Parcelle, Boston, Mass.

563,960. Electric Light for Cold-Storage Rooms. D. B. Hawkes and R. H. Hawkes, Springfield, Mass.

564,036. Electric Headlight for Street Cars. A. C. Thompson, St. Louis, Mo., M. DeWitt, Morrillton, and W. K. Elliott, Little Rock, Ark.

564,084. Protective Appliance for Electrical Apparatus. A. de Khotinsky, Boston, Mass.

564,101. Printing Telegraphy. J. J. Reifgraber, St. Louis, Mo.

564,168. Speed and Direction Indicator. G. A. Tower, Richmond, Va.

564,173. Telephone-Exchange Apparatus. J. J. Carty, New York, N. Y.

564,174. Armored Insulating-Conduit. R. T. Elwell, Hyde Park, Mass.